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Framing the User Experience in Mobile Newsmaking with Smartphones

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Framing the User Experience in Mobile Newsmaking with Smartphones

Thesis for the degree of Doctor of Science in Technology to be presented with due permission for public examination and criticism in Tietotalo Building, Auditorium TB109, at Tampere University of Technology, on the 11th of April 2014, at 12 noon.

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Abstract

Mobile handheld devices are changing the practices of newsmaking, the roles of journalists and readers in it, and the published news in profound ways. The activity of mobile newsmaking aims at a tangible outcome, the news, which are consumed by an audience. Relatively little research exists in HCI (Human-Computer Interaction) that explores what is user experience of mobile systems in goal-oriented creative activity in organizational settings and especially in the natural contexts of use. This thesis addresses this gap by focusing on user experience, which arises when smartphones are used in mobile newsmaking to create and publish online and print news in the newspaper industry.

This thesis has two main goals. First, it aims to gain a holistic understanding of user experience in mobile newsmaking with smartphones from the viewpoint of mobile reporters as users. Second, it explores how mobile and location-based assignments assigned by the newsroom can support cooperative newsmaking.

This thesis contains nine scientific publications based on twelve case studies. The research approach of the studies is primarily qualitative. Seven of the studies included the usage of a mobile service client for newsmaking in the mobile context of use. Two of the twelve studies concentrated on reader participation in newsmaking as a form of mobile crowdsourcing. The rest of the studies focused on professional use. Over one hundred participants participated in the studies, of which a majority were students of visual journalism with prior work experience in journalism. The empirical findings are synthesized in the thesis summary. The model of user experience in mobile newsmaking with smartphones and the process model for mobile assignment-based processes summarize the thesis work on user experience and cooperative processes.

User experience in mobile newsmaking is constructed in a process of using the mobile system in a goal-oriented and creative activity in the mobile context of use. The activity of mobile newsmaking consists of several subactivities starting from encountering a newsworthy event to the publishing of the news. It may include mobile reporter's cooperation with others, who are in the field or in the newsroom. The constructed model of user experience has seven main components: user, system, the context of use, tangible outcome, descriptive attributes, overall evaluative judgments, and consequences. The model emphasizes the characteristics of the tangible outcome of system use (news material, news) as a fourth component that can contribute to user experience in addition to the characteristics of the user, system and the context of use. User's experienced quality of the system is described by verbally expressible descriptive attributes divided to four components. The components of the descriptive attributes are the quality of the outcome (technical and content-based quality) and the perceived impacts (benefits and costs) that complement instrumental (pragmatic) and non-instrumental (hedonic) qualities from prior models of user experience.

Ease-of-use, speed, light weight, small-size, unobtrusiveness, reliability, connectivity, controllability, being always along, and multifunctionality are key attributes for positive user experience. For users, pride of the outcome, fit with needs, motivations and goals, feeling of being in control, mastery of the system and activity, and the fit of the system to user's role and situation are important. The process model for mobile assignment-based processes illustrates the coordination and

cooperation related information and communication needs of the mobile reporter and the newsroom at differenct phases of newsmaking.

The constructed models and synthesized results can aid academics and practitioners when designing, studying, and evaluating solutions for mobile work that can be complex, cooperative and creative and which aims at a perceivable or tangible outcome. They can also aid in recognizing the critical success factors of the solutions for different types of users and circumstances of the context of use. Further, results can aid when selecting and planning ICT solutions for media organizations and when planning the related editorial processes, workflows, and work roles. Finally, the constructed models can be used and validated in future research in other fields of mobile work and crowdsourcing.

Preface

This thesis work has been a journey that started in spring 2008 with what appeared to be just one case study on mobile journalism. The opportunity for this first study emerged from a discussion with my former colleague from Nokia Research Center over a breakfast at a downtown hotel. Within a month we were in the field carrying out a user study with students of journalism and visual journalism at University of Tampere. Ever since this first study I have been extremely fortunate to be able to cooperate with many wonderful people that have enabled the studies and provided their help and support within academia, companies providing technological solutions, and news organizations.

I would like to thank my supervisor Prof. Kaisa Väänänen-Vainio-Mattila, who has trusted and supported me along the way in numerous ways. Kaisa has given me the freedom to satisfy my curiosity on various paths along the way, make my own independent choices in terms of methodology, research questions, and theory, and focus on journalism as the application area. I value this greatly, since learning is a process, trying your own wings is the only way to grow to an independent researcher, and thinking takes its own time and space.

Prof. David Frohlich and Assoc. Prof. Louise Barkhuus reviewed the thesis. I am thankful for their insightful and constructive comments. I am hounoured that Professor Susanne Bødker agreed to act as the opponent in the public thesis defense.

Adj. Prof. Satu Jumisko-Pyykkö has given her time, help, and support especially during the past two years. I am grateful to her for the to the point, but discreet observations and questions, comments on the thesis manuscript, as well as for the refreshing walks. What I have learned from Satu goes beyond what I can express in a few words.

I am grateful to the co-authors of the papers for their contributions to publications. First, I would especially like to thank Prof. Anssi Männistö, who enabled to carry out several user studies with the students of visual journalism. Anssi's insight on visual journalism development and Anssi' great enthusiasm and positivity has been inspiring. I thank my colleagues from our research group, Tiina Koponen, Heli Wigelius, and Dr. Teija Vainio as well as Dr. Virpi Roto during her visit to our unit. They have in different invaluable ways contributed to the publications, research, or both. In addition, I have had an opportunity to collaborate with Prof. Paul Egglestone in a user study in Preston, UK, and in writing of publications. Paul's experience in media industry, and contribution gave a new angle to the studies and publications. It was a great pleasure and enjoyable to work with Esa Sirkkunen and Kari Salo during the first study on reader participation and in the writing of the publication. I am glad that our cooperation with Esa has continued fruitfully. Tero Jokela was involved in the first user study of the thesis and he participated in writing of some of the related publications. His experience and insight was valuable at the start of the research in this field.

I am thankful for valuable feedback, guidance, and support from a number of people during the thesis work: Prof. Kari-Jouko Räihä (UCIT), Assoc. Prof. Antti Oulasvirta (UCIT), Dr. Sari Kujala, Dr. Timo Partala, Dr. Marko Seppänen, Dr. Eija Kaasinen, Dr. Marja Liinasuo, Dr. Merja Helle, and Prof. Timo Saari. With Dr. Maria Antikainen we have shared the research interest in open innovation - we had great fun, thanks Maria for the enjoyable moments and joint learning expriences!

I express thanks to my colleagues at our research group during 2008-2013. I especially thank Anni Uusitalo and Katja Suhonen for their contributions to the research and carrying out user studies. Emilia Pesonen and Mari Ahvenainen helped in their own ways this thesis come true. With Piia Nurkka I have shared the ups and downs of thesis work. I am indebted to Piia for being such a great peer support and also for reading and commenting some drafts along the way. Jarmo Palviainen, Kati Kuusinen, Dr. Thomas Olsson, Tanja Walsh, Jari Varsaluoma, Hannu Soronen, Sanna Malinen, Jari Halonen and Jarno Ojala have shared some of the coexperiences in daily research life. Many more people have helped with the practicalities of projects in our department in different ways, special thanks especially to Hilkka, Hippi, Jaffa and Kirsi. And my very first employer at the university some x years back, Heimo Ihalainen - your rocking chair saved my day a couple of times!

I am grateful to have received funding from several sources that have enabled the thesis work. First, the funding by the Ministry of Education (PALTI project 2007-2009) enabled the starting of the research in the field of journalism. In 2009 we were also funded by two direct company projects with Nokia Research Center on mobile journalism. I was happy to receive a funded position for 2010-2012 from the UCIT (User-Centered Information Technology) that enabled to carry on the thesis work. The Next Media programme of DIGILE (2010-2014), funded by TEKES, gave an opportunity to expand the thesis work on cooperative newsmaking processes to readers. In addition, the funding by UXUS programme of FIMECC (2011-2015), funded by TEKES, gave an opportunity to focus on the theoretical side of user experience. The received funding has given me a great opportunity to learn and dive into something that I have enjoyed studying tremendously.

I want to thank all the participants of the studies – without you this thesis would not have been possible. The companies that have been involved in the studies and their representatives have been essential for realizing the studies we have carried out. I want to express my thanks especially to Timo Koskinen, Lauri Kaisanlahti, Seppo Roth, Janne Kaijärvi, Santtu Parkkonen, and Tuukka Muhonen.

In the thesis work I have been fortunate to be able to carry out research in the same application field for the whole duration of the thesis work. It has enabled to create a deeper understanding of the field of journalism and the development of technology supported solutions and processes for it. Several paths have been taken during the thesis work from mobile reporting to studying work and work processes in the newsrooms as well as the cooperative aspects and crowdsourcing. Part of what has been studied and learned is captured in this thesis summary and the included publications.

My warmest thanks belong to my family - Risto, Tuisku, Pyry, and Panu - as well as to my parents Vuokko and Pertti. My parents have shown their support in so many ways through these years of thesis work that I cannot express my gratitude enough. Alli, my mother-in-law, always offered a place to rest for a few minutes and a cup of coffee with a chat of everyday things when needed. Risto, your patience, understanding, and support have been more important than anything else during these years. Without you, this thesis would not have come to realization. Tuisku, Pyry, and Panu – you are the most precious things in the world. Thank you for being you! Finally, our four-legged family members – thanks for taking me out regularly into the fresh air!

Tampere, March 16th, 2014 Heli Väätäjä

Supervisor:	Professor Kaisa Väänänen-Vainio-Mattila Department of Pervasive Computing Tampere University of Technology
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	Associate Professor Louise Barkhuus Stockholm University Sweden
Opponent:	Professor Susanne Bødker Aarhus University Denmark

Contents

List of publications

The thesis consists of a summary and the following original publications:

P1 Väätäjä, H. 2010. User experience evaluation criteria for mobile news making technology: findings from a case study. *Proceedings of the 22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction* (OZCHI '10). ACM, New York, NY, USA. pp. 152-159.

P2 Wigelius, H. & Väätäjä, H. 2009. Dimensions of Context Affecting User Experience in Mobile Work. *Proceedings of Human-Computer Interaction--INTERACT 2009, part II, LNCS 5727*. Springer Berlin Heidelberg. pp. 604-617.
[Candidate's contribution to the publication 50%]

P3 Väätäjä, H., Koponen, T. & Roto, V. 2009. Developing practical tools for user experience evaluation: a case from mobile news journalism. *European Conference on Cognitive Ergonomics: Designing beyond the Product --- Understanding Activity and User Experience in Ubiquitous Environments* (ECCE '09). VTT Technical Research Centre of Finland, VTT, Finland. pp. 240-247.
[Candidate's contribution to the publication 95%]

P4 Väätäjä, H. 2010. User experience of smart phones in mobile journalism: early findings on influence of professional role. *Proceedings of the 22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction* (OZCHI '10). ACM, New York, NY, USA. pp. 1-4.

P5 Väätäjä, H. & Männistö, A.A. 2010. Bottlenecks, usability issues and development needs in creating and delivering news videos with smart phones. *Proceedings of the 3rd workshop on Mobile video delivery* (MoViD '10). ACM, New York, NY, USA. pp. 45-50.
[Candidate's contribution to the publication 90%]

P6 Väätäjä, H. 2012. Mobile work efficiency: Balancing between benefits, costs and sacrifices. *International Journal of Mobile Human Computer Interaction (IJMHCI)*, *4*(2). pp. 67-87.

P7 Väätäjä, H. & Egglestone, P. 2012. Briefing news reporting with mobile assignments: perceptions, needs and challenges. *Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work* (CSCW '12). ACM, New York, NY, USA. pp. 485-494.
[Candidate's contribution to the publication 90%]

P8 Väätäjä, H., Vainio, T., Sirkkunen, E. & Salo, K. 2011. Crowdsourced news reporting: supporting news content creation with mobile phones. *Proceedings of the 13th International Conference on Human Computer Interaction with Mobile Devices and Services* (MobileHCI '11). ACM, New York, NY, USA. pp. 435-444.
[Candidate's contribution to the publication 80%]

P9 Väätäjä, H., Vainio, T. & Sirkkunen, E. 2012. Location-based crowdsourcing of hyperlocal news: dimensions of participation preferences. *Proceedings of the 17th ACM international conference on Supporting group work* (GROUP '12). ACM, New York, NY, USA. pp. 85-94.
[Candidate's contribution to the publication 90%]

The publications are reproduced by the permission of the publishers. The candidate's contribution is expressed as a percentage of the written work of the publication in case of multiple authors. Appendix 1 presents the contribution of the candidate in detail. In addition to the included publications, the thesis summary synthesizes results from four other publications that the candidate has contributed to within the thesis research.

List of acronyms

BPS	Bits per second
CSCW	Computer-Supported Cooperative Work
CoU	Context of Use
EGPRS	Enhanced GPRS, EDGE
FPS	Frames per second
GPRS	General Packet Radio Service
HCI	Human-Computer Interaction
IS	Information Systems
ISO	International Standardization Organization
KBPS	Kilobits per second
LBA	Location-based assignment
LBS	Location-based service
LCD	Liquid-Crystal Display
MHCI	Mobile Human-Computer Interaction
MMS	Multimedia Messaging Service
MPEG	Motion Pictures Expert Group
PDA	Personal Digital Assistant
QCIF	Quarter Common Interchange Format (176x144)
QVGA	Quarter Video Graphics Array (640×480)
SMS	Short Message Service (text messaging service)
TAM	Technology Acceptance Model
TTF	Task-Technology Fit
UCD	User-Centered Design
UMTS	Universal Mobile Telecommunications System
UTAUT	Unified Theory of Acceptance and Use of Technology
VGA	Video Graphics Array (640x480)
2D	Two-dimensional, monoscopic video presentation
2G	Second-generation cellular network
2.5G	Second and a half generation cellular network, employs GPRS
3G	Third generation cellular network, employs UMTS

1. Introduction

A reporter from Göteborgs-Posten emailed the best photo he took with a cameraphone from an accident scene to the news desk (Outing, 2003). The photo was published in the online version of the story (ibid.). The news desk considered the photo to be better in terms of news quality than the technically higher quality photo taken by a photographer 20 minutes later (ibid.).

Since the first news photos were shot with cameraphones in 2003, the importance of news photos and videos captured with mobile phones equipped with cameras has increased rapidly. Cameraphones and converged smartphones empower journalists and transform their work (Mabweazara 2011, Martyn 2009, Quinn 2011, Westlund 2013) as well as change the news we see (Martyn 2009). Smartphones free journalists from location dependency, enable their mobility, and have become part of the everyday work of journalists without which a professional could not cope (Mabweazara 2011).

Gillmor proposed in 2004 that technology empowers readers to become part of the newsmaking process (Gillmor 2004, Gillmor 2008). Cameraphones and smartphones have truly enabled citizens to participate in newsmaking and democratize the newsmaking. During the 2009 and 2011 Arab uprisings ordinary people shared content created on the streets in social media or sent in material directly to the BBC newsroom (Hänska-Ahy et al., 2012). As professional journalists were resctricted from access to events on site, the citizens were reporting unfolding fast-paced events (ibid.). Professionals became heavily reliant on the user-generated content during the events and both content creators and the newsrooms co-adapted their practices (ibid.). The eyewitness accounts and images of breaking news, often created and shared with mobile phones, have become part of the international and national news reporting.

Media organizations are increasingly engaging readers to newsmaking to get interesting content and insights, and on the other hand, to aim for cost-effectiveness in their own operation. CNN has established an active reader reporter community for readers "iReporters" that stretches all over the world through the CNN's dedicated mobile client, Twitter, and online site (CNN online). CNN has also used a mobile crowdsourcing platform Jana (Jana online) when surveying opinions in emerging markets, such as in Africa. Most African users have low-end feature mobile phones with simple browsers and they receive mobile airtime as an incentive of participation (journalism.co.uk online). Scoopshot offers a differing model for user participation with a marketplace of news photos and videos for freelancers and citizens to sell their content to media companies (Scoopshot online). It also acts as an outsourcing as well as a crowdsourcing platform enabling news publishers to create assignments for freelancers and citizens to undertake. These examples show how technology has transformed both the work of professionals and enabled the cooperation with citizens as Gillmor (2004, 2008) proposed.

To be able to design and develop systems and processes for mobile newsmaking, it is essential to gain a holistic understanding of mobile reporter's user experience in terms of what contributes to it, what are the required system characteristics and what are the impacts of usage perceived by the

mobile users. Prior Human-Computer Interaction (HCI) research on user experience in organizational settings or in mobile newsmaking focuses primarily on the features and functionalities of mobile systems (e.g. Hickey et al. 2007, Streefkerk et al. 2008, Streefkerk et al. 2009) or evaluation of user experience (Markova et al. 2007, Vuolle et al. 2008a, Vuolle et al. 2008b). Less attention is paid to the other factors that contribute to user experience, such as the characteristics of users and the context of use, the mobile processes that are used in coordination of the work as well as the impacts of usage. Most of the research related to user experience of utilitarian systems in organizational settings is found in the field of Information Systems (IS), where hedonic quality perceptions or hedonic value have been research themes also in the context of work systems (Lee et al. 2006, Wakefield et al. 2006) in addition to a few exceptions in HCI (Schrepp et al. 2006). The research on impacts of mobile technology and mobile services primarily focuses on the benefits (Vuolle 2011), rarely focusing on real-life experiences (Sørensen et al. 2004, Sørensen et al. 2008).

Currently, little is known about the user experience of mobile technology in organizational settings. User experience of mobile users is relatively unexplored both in work context or in crowdsourcing, that is, when outsourcing tasks to a crowd (Howe 2006, 2008). The tensions between the creative work of a news professional and his/her professional identity, the constantly changing work practices and the new ways of reporting enabled by mobile technologies – and not only for professionals working in the field but also when working jointly with readers – creates an area to explore. These issues do not only relate to individuals but also have wider implications on the practice of newsmaking, the situational nature of news quality, and the impacts that span from individuals to organizations, journalism and to societal level through the empowerment of citizens.

1.1 Objectives and scope

Objectives. This thesis has two main research objectives (Table 1). The first objective is to understand the user experience when using smarthpones in the mobile newsmaking activity. The outcome is a model of user experience in mobile newsmaking with smartphones. The second objective is to understand how smartphones can support cooperative newsmaking either when professionals or the "crowd" is involved in the activity, and specifically when using mobile and location-based assignments created by the newsroom staff. The outcome is a process model for the phases of mobile assignment-based newsmaking processes that describes the coordination and cooperation related information and communication needs by the newsroom and mobile reporter.

Table 1. The relationship between the research questions and the publications.

Research Questions	*Publications*
RQ1. What is user experience in mobile newsmaking with smartphones?	P1, P2, P3, P4, P5, P6, P7, P8, P9
RQ2. How can mobile and location-based assignments support cooperative newsmaking?	P7, P8, P9

Theoretical background. This work combines two streams of research. This thesis belongs primarily to the field of HCI: "*Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them."* (Hewett et al. 1996). Within HCI, this work intersects the following research areas: user experience, mobile and ubiquitous computing, and computer supported cooperative work (CSCW). Secondarily, this work reviews some empirical research findings and theoretical models from the field of Information Systems (IS). Within IS, this work relates primarily to the research on the mobile systems in work and organizational settings, the acceptance and impacts of technology as well as to the concept of perceived quality. Even though HCI and IS are separate disciplines (see Grudin [2012] for a recent discussion), they have overlappings that this thesis utilizes when aiming for a holistic understanding of user experience in the context of the study.

Scope. The scope of this thesis is to explore and understand user experience when smartphones are used as mobile tools and enablers for mobile newsmaking. A smartphone is "*a mobile telephone with computer features that may enable it to interact with computerized systems, send e-mails, and access the web*" (MOT Collins English Dictionary). In this research, *portable mobile technology* refers specifically to smartphones with their features and functionalities, including multimedia capabilities, as well as mobile services and mobile applications (adapted from Vartiainen, 2006) that are used in the mobile newsmaking process. *Mobile application* refers to a stand-alone application installed on the device that has or uses no cellular or wireless connectivity, whereas *mobile service* refers to a mobile service client software installed on the smartphone or a service available through the smartphone which enables data transmission or communication in one or two directions (adapted from Verkasalo, 2009). In this work *mobile newsmaking* refers to the activity in mobile context of use that uses portable mobile technology to capture, edit, create, share, send and/or publish news or news content such as text, audio, photo, video or their combinations, as well as to the related cooperative newsmaking processes carried out with portable mobile devices (adapted from the definition for *mobile journalism* in S4). The activity is facilitated by a news organization.

Methodology. The thesis contains results from twelve case studies published in nine publications. As the overall aim of this work was to understand the user experience in the natural context of use, situations and contexts of use as close as possible to real-life were chosen for the studies. Seven of the studies included the usage of a dedicated mobile service client for newsmaking in the field. Five studies explored current practices, users' needs and impressions, and the usage of smartphones in newsmaking. Two of the twelve studies concentrated on reader participation in newsmaking (reported in P8, P9), and the rest of the studies concentrated on use of smartphones for professional newsmaking (reported in P1-P7). Over one hundred participants participated in the studies.

The research approach is primarily qualitative. Ten of the twelve studies were exploratory case studies. Two of the case studies were carried out as quasi-experiments in field conditions. The used data collection methods included observations of usage, interviews, questionnaires, and focus groups. The results of the studies are published in nine scientific publications (one in a journal, seven in conferences, and one in a workshop). The candidate is the first author in eight publications and

makes a significant contribution in all papers (see Appendix 1 for details). In addition, the candidate refers to four other publications in the theme of her thesis that are used in the synthesis of the results in thesis summary.

1.2 Results and contribution

This thesis provides two main outcomes as theoretical and practical contributions: the model of user experience in mobile newsmaking with smartphones and the process model for mobile assignment-based processes.

First, as the main outcome of the thesis work and as an answer to the first research question **a model of user experience in mobile newsmaking with smartphones is presented based on the synthesized empirical findings presented in the publications and prior models of user experience** (see Figure 18). The model of user experience has seven main components: user, system, the context of use, tangible outcome, descriptive attributes, overall evaluative judgments, and consequences. Extending the prior models of user experience, the model emphasizes the characteristics of the tangible outcome of system use (news material, news) as a fourth component that can contribute to user experience in addition to the characteristics of the user, system and the context of use. User's experienced quality of the system is described by verbally expressible descriptive attributes related to the quality of the outcome (technical and content-based quality) and the perceived impacts (benefits and costs) complementing the instrumental (pragmatic) and non-instrumental (hedonic) qualities from prior models of user experience. The descriptive qualities can contribute to the overall evaluative judgments of the system (appropriateness to use, enjoyment of use, enjoyment of goal achievement, and excellence), which can be moderated by the characteristics of the user, system, the context of use and the tangible outcome. The components can further contribute to the consequences of user experience, such as system acceptance, motivation, usage behavior, job satisfaction and participation to crowdsourcing.

Some of the key system attributes related to positive user experience are ease-of-use, speed, light weight, small-size, unobtrusiveness, reliability, connectivity, controllability, practicality, being at hand when needed and multifunctionality. For users, pride of the outcome, fit with needs, motivations and goals, feeling of control, mastery of the system and activity, and the fit of the system to user's role and situation are important.

The model of user experience extends prior theoretical models of user experience by including the characteristics of the tangible outcome of system usage to the components that can contribute to user experience. Furthermore, the descriptive attributes that describe the user's experienced quality of the system include quality of the outcome and perceived impacts to complement the instrumental and non-instrumental qualities. The model provides a conceptual framework that supports user-centered design activities as well as the evaluation of systems that are used for creating tangible outcomes within real-life activity. The findings have been used in practice when developing systems for mobile newsmaking and for mobile work.

Second, as complementary contribution, **an extensive description of the characteristics of the context of use** (see Table 13-Table 17) that can contribute to user experience in mobile newsmaking

is presented, detailing the components, sub-components, and the properties of the context of use. The model presented in P2 for the context of use in mobile work is elaborated in the thesis summary. The CoU-MHCI model by Jumisko-Pyykkö & Vainio (2010) is used as the framework for categorizing the findings with five context components (temporal, physical, social, task, and technology and information context). Altogether nineteen sub-components of the context of use are described based on the thesis work, extending the CoU-MHCI model by three sub-components. The extensions are the following. Task context was extended with assignment characteristics, physical context with the characteristics of the area, location or country, and social context was extended to include the stakeholders who are not physically present when interacting with the device, but who assess the quality of the news material and reporting. The identified properties of context of use covered the level of magnitude, the level of dynamism, and patterns – confirming the model by Jumisko-Pyykkö et al. (2010). Findings seem to indicate that the combination of the characteristics of the context of use can contribute not only to acceptance of outcome quality, but it may also moderate the appropriateness to use.

The synthesized empirical findings on the context of use from the publications validate the CoU-MHCI model in mobile newsmaking, extend it and elaborate the definitions for the components. The model with descriptions for the components and subcomponents can be applied by practitioners when designing systems for mobile work that utilize location technologies or context-awareness, mobile assignments, as well as to identify typical combinations of context characteristics. It also supports the management in news organizations to understand how circumstances can contribute to user experience and acceptance of the systems when planning their uptake and related editorial processes in newsmaking.

As an answer to the second research question, the second main contribution is the **process model for mobile assignments which summarizes the work on cooperative processes related to mobile and location-based assignments** (see Figure 17). It describes coordination and cooperation related information and communication needs of the mobile reporters and the newsroom at different phases of the mobile assignment-based processes. Based on the identified needs and the process model, practical guidelines have been created for the information content of the mobile assignments (see Table 20 for a summary) and planning processes for crowdsourcing of news content from the readers. The guidelines have been disseminated to a news organization for the planning of practical mobile crowdsourcing trials with readers and implementing the processes.

In relation to the process model and use of assignments, **a framework for the characteristics of the context of use that can contribute to user participation in the case of mobile and location-based assignments** is presented (see Table 19). The framework summarizes the findings from the studies with professionals and reader reporters. It helps the news publishers in planning their assignment-based activities by an increased understanding of the circumstances that can contribute to participation. It has been applied in research designs of practical trials with reader reporters in real-life context of hyperlocal news publishing (Väätäjä et al. 2013).

The contributions of the publications, the key areas of the related literature, and keywords are presented in Table 2.

1.3 Structure of the thesis summary

The thesis is organized as follows. An overview of the related literature from the key research streams for the thesis summary is provided in Chapters 2 and 3. Chapter 2 presents an overview of key concepts and models related to user experience primarily from the field of HCI, but also from the field of IS. Chapter 3 covers key concepts and background related to mobile newsmaking, especially from the point of view of mobile work. A summary of the research approach and methods is presented in Chapter 4. The results are presented in two parts in section 5 answering to the research questions presented in this chapter (Chapter 1). Firstly, the findings presented in the publications are synthesized to identify components and their characteristics that can contribute to user experience and the quality-based components of user experience. In addition, a rich description of the characteristics of the context of use is presented, validating and extending a prior model of context of use. Secondly, the elements that can contribute to participation and a process model for cooperation when using mobile and location-based assignments are presented. Chapter 6 discusses the contributions and implications of the synthesized thesis outcomes, describes an assessment of the research, suggests future research and concludes the study.

Table 2. Characterizing the publications by key areas of related literature, keywords, contributions and contribution types (T = theoretical, M = methodological, P = practical).

Publication	*Key areas of related literature*	*Keywords*	*Contributions*	*Contribution types*
P1. User experience evaluation criteria for mobile newsmaking technology – Findings from a case study	User experience, smartphones in mobile use, motivation, TAM (technology acceptance model)	The context of news journalism, goals and motivations for newsmaking	Contextual and personal evaluation criteria for assessment of mobile newsmaking technology	T, P
P2. Dimensions of context affecting user experience in mobile work	The mobile context of use, mobile work, user experience	The context of use, mobile work	The dimensions and characteristics of the mobile context of use	T, P
P3. Developing practical tools for user experience evaluation: a case from mobile news journalism	Perception of system qualities, user experience	Perceived instrumental (pragmatic) and non-instrumental (hedonic) quality	Quality attributes for mobile newsmaking technology	T, P, M
P4. User experience of smart phones in mobile journalism: early findings on influence of professional role	Perception of system qualities, user experience	Perceived instrumental (pragmatic) and non-instrumental (hedonic) quality	Subjective quality perceptions, professional role as a determinant	T, P
P5. Bottlenecks, usability issues and development needs in creating and delivering news videos with smart phones	Usability issues and components affecting user experience of smartphones, mobile videos	Mobile video, usability, user experience	Critical components affecting user experience in case of mobile news videos	T, P
P6. Mobile work efficiency – Balancing between Benefits, Costs, and Sacrifices	Usability, productivity, mobile work, the impacts of smartphones	Efficiency, effectiveness, the impacts of smartphones	The impacts of using smartphones as perceived by end-users	T, P
P7. Briefing news reporting with mobile assignments – Perceptions, needs and challenges	Location-based services, privacy, mobile assignments	Mobile assignments, location, privacy	Components affecting user experience and participation, implications for mobile assignment based collaborative processes and technology	T, P
P8. Crowdsourced news reporting – Supporting news content creation with mobile phones	User experience	Smartphones in readers' content craation	User experience components when using smartphones to create and submit reader's contet.	T, P
P9. Location-based crowdsourcing of hyperlocal news – Dimensions of participation preferences	Privacy, crowdsourcing, LBS (location-based services)	Location-based crowdsourcing, privacy, participation preferences	Framework for participation preferences; implications for design	T, P

2. The key concepts and models of user experience

This chapter presents the theoretical background on user experience by presenting an overview and a synthesis of the key concepts (section 2.1) and user experience related models from the fields of HCI (section 2.2) and IS (section 2.3) that are relevant to this thesis work. The main emphasis is on concepts and models that focus on the descriptive qualities as components of user experience models. The presented concepts and models are a basis for the quality-based model of user experience presented as an outcome of the thesis work. They have been used in the different phases of the thesis work. The contribution to the thesis work from the different fields of science is illustrated in Figure 1.

Choosing what concepts and theoretical background to use is part of the research process. These decisions are made typically at the beginning of the research. However, when the emphasis is on qualitative research and the case study approach is used, the theories are revisited and new theories searched for throughout the research process (Yin, 2003). Theories are used for searching for explanations and in interpreting the results. On the other hand, they can work as rival theories for the findings (ibid.). In addition, when this thesis work began, in early 2008, relatively few theories on user experience were available and the concepts used related to user experience were often somewhat vaguely defined.

The overview of the key concepts and models relevant to this thesis work are synthesized in section 2.4 to provide the basis for presenting the related work in the next chapter on mobile work and mobile newsmaking. The concepts and models are used when constructing the user experience model in Chapter 5 based on the findings of this thesis work and prior research.

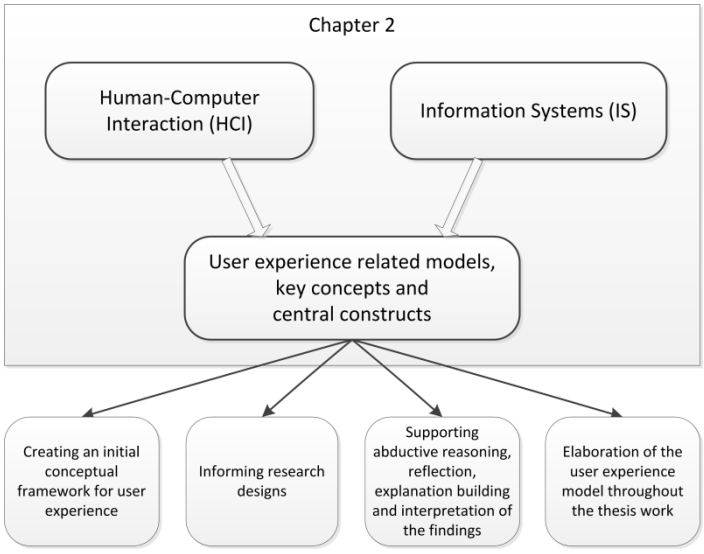

Figure 1. Models, key concepts and constructs related to user experience from the fields of HCI and IS and their relation to this chapter and the thesis work.

2.1 Key concepts

This chapter presents and discusses the key concepts used in this thesis summary related to quality-based approach to user experience. First, definitions for user experience are described. Second, definitions for concepts related to quality and perceived quality are presented as components of user experience models. Third, the consequences of user experience are presented.

2.1.1 User experience

One of the first definitions for user experience in the field of HCI is presented by Alben (1996). She describes user experience as follows: *"By "experience" we mean all the aspects of how people use an interactive product: the way it feels in their hands, how well they understand how it works, how they feel about it while they're using it, how well it serves their purposes, and how well it fits into the entire context in which they are using it."* Alben explicitly uses the concept of quality of experience for these experiences (ibid.). She describes the quality of experience by the following characteristics (ibid.): appropriate, learnable, usable, aesthetically pleasing, sensually satisfying, and manageable. Experience includes sensorial, cognitive, emotional, and reflective components.

Since this definition, numerous definitions for user experience have emerged, both in academia and in companies (All about UX). The ISO standard for *Human-centred design for interactive systems* (ISO 9241-210:2010) defines user experience as a *"person's perceptions and responses that result from the use/or anticipated use of a product, system or service"*. Hassenzahl and Tractinsky (2006) underline the subjectivity, situatedness, complexity, and dynamicity of user experience to stimulate further research on user experience in HCI. They emphasize that in the user's interaction with a system there are three influencing factors: user, system, and context of use (Hassenzahl and Tractisnky, 2006). These basic influencing factors of user experience are also present in the definition of usability defined as the *"extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use."* (ISO 9241-11:1998). Usability can be viewed as one of the determinants of user experience (ISO 9241-210:2010).

The clear difference in the emphasis of recent user experience definitions compared to usability is the focus of user experience beyond the instrumental. Although Alben (1996) includes "serving the purpose" and "fit into the context of using" into the quality of user experience, they seem to be missing in the more recent definitions of user experience. As the focus of this thesis is the activity of mobile newsmaking in journalism practice, this thesis ultimately explores whether the tangible outcome that is related to the user's goals is linked to user experience.

In this thesis, I see user experience to be verbally expressed as user's impressions and reactions that are influenced by the user's interaction with the system, the tangible outcome of the system use, the activity within which the interaction occurs, and the context of use. The characteristics of the user, system, and the context of use contribute to the interaction with the system, the activity with its goals, and the user's experience. Next, I discuss the notion of quality as well as the qualities discussed in the quality-based models of user experience, namely instrumental (pragmatic) and non-instrumental (hedonic) quality. I also discuss how the consequences of user experience have been

addressed in the prior literature in the fields of HCI and IS, as they are often included in user experience models.

2.1.2 Quality

As the theoretical approach of the thesis to user experience focuses on the quality-based models of user experience, this subsection discusses first the the notion of quality. It then presents the two central groups of qualities that are present in many of the user experience models: the instrumental (pragmatic) and non-instrumental (hedonic) quality.

2.1.2.1 Definitions of quality

Quality is defined as *"the standard of something as measured against other things of a similar kind; the degree of excellence of something"* and as *"a distinctive attribute or characteristic possessed by someone or something"* (New Oxford American Dictionary, 2012). The quality management systems standard defines quality as the *"degree to which a set of inherent characteristics fulfills requirements"* (ISO 9000:2005), specifying characteristic as a *"distinguishing feature"*. A characteristic can be a) inherent or assigned, and b) qualitative or quantitative, and there are various classes of characteristics, such as physical, sensory, behavioral, temporal, ergonomic, and functional characteristics (ISO 9000:2005). A quality characteristic is further described as an inherent characteristic of a product, process, or system (ISO 9000:2005).

The standard for software and systems engineering defines the quality of a system: *"[...] the degree to which the system satisfies the stated and implied needs of its various stakeholders, and thus provides value"* (ISO/IEC 25010:2011). Product quality can be categorized into characteristics, and further subdivided into subcharacteristics (ISO/IEC 25010:2011). The measurement of quality related properties is described as follows: *"The measurable quality-related properties of a system are called quality properties, with associated quality measures"* (ISO/IEC 25010:2011). According to this standard, quality in use is *"the degree to which a product or system can be used by specific users to meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk and satisfaction in specific contexts of use"* (ISO/IEC 25010:2011). This definition closely resembles the definition of usability described previously.

I approach quality in this thesis as qualitative descriptive attributes (i.e., characteristics and subcharacteristics) of a system, service, or process and as perceived and/or described by the user, and as the user's perception of the degree to which their needs and requirements are fulfilled. By perceived quality I refer to the user's subjective perception of an object's quality, that is, its characteristics or attributes, whether the object is a system, an application, a mobile service, a process, an outcome of the usage of a system, or an impact of the adopted technology on the current situation, activity, or practices.

2.1.2.2 Instrumental or pragmatic quality

In the quality or attribute-based approaches to user experience in the field of HCI, two distinct groups of system or user experience qualities (attributes) are referred to. The first group is composed of pragmatic, utilitarian, or instrumental qualities or attributes (Hassenzahl, 2003, 2004; Mahlke, 2008; Mahlke et al. 2007; Thüring et al. 2007). The second group is composed of hedonic, non-utilitarian, or non-instrumental qualities or attributes (Hassenzahl, 2003, 2004; Mahlke, 2008; Mahlke et al. 2007; Thüring et al. 2007).

Hassenzahl (2004) describes pragmatic attributes to be *"connected to users' need to achieve behavioral goals,"* which *"requires utility and usability"*. Similarly, Mahlke (2008, p. 43) defines that *"the instrumental value of an interactive system is related to the tasks and goals that the user wants to accomplish with a system"*. He suggests that both "*utility* (defined as usefulness by Davis, 1989) *and usability* (defined as ease of use by Davis, 1989) *determine the instrumental value of an interactive system"*. He further suggests that the perception of instrumental qualities is comprised of utility and usability, specifically including efficiency, controllability, helpfulness, and learnability as dimensions of usability (Mahlke 2008, p. 44).

In this thesis instrumental, i.e., pragmatic, quality refers to the system qualities (attributes) that are related to the interaction, activity, information, and cooperation aiming specifically to tangible outcomes that the user aims to accomplish with the system when using it in the activity as discussed in Chapter 5 (see Figure 18).

2.1.2.3 Non-instrumental or hedonic quality

Non-instrumental or hedonic qualities are pleasure-producing system qualities (Law et al. 2010). Hassenzahl (2004) describes hedonic qualities to be *"primarily related to user's self"*. He divides hedonic qualities into stimulation and identification: Stimulation is related to personal development (related to knowledge and skills) and identification addresses the human need to express one's self through objects, as objects communicate important personal values. Mahlke (2008, p. 45–46) states that the "*non-instrumental qualities of an interactive system satisfy user needs that go beyond the instrumental value of the product*". He includes symbolic (communicative symbolics, associative symbolics), aesthetic (visual aesthetic, haptic quality, acoustic quality), and motivational aspects into the perceptions of non-instrumental qualities. Neither Hassenzahl, nor Mahlke, discuss a tangible outcome of system usage, such as a photo, or a story, created with the used system in relation to non-instrumental or hedonic quality.

In consumer research hedonic consumption is described as "*those facets of consumer behavior that relate to the multisensory, fantasy, and emotive aspects of one's experience with products*" (Hirschman et al. 1982) and hedonic aspects have been proposed *"to identify strong emotional reactions to stimuli"* that may also be something other than positive and pleasant, such as reacting with fear (Spangenberg et al. 1997). In the field of IS research, empirical research and scale development on hedonic aspects has focused on perceived enjoyment, playfulness, cognitive

absorbtion and flow (see e.g., van der Heijden et al. 2003; Wakefield et al. 2006). In HCI, Mahlke (2008), for instance, explicitly separates the emotional responses from non-instrumental qualities.

I approach non-instrumental qualities based on the definition presented by Mahlke (2008), as descriptive qualities of the system that satisfy user needs beyond the instrumental value of the system with components for the quality of stimulation and identification.

2.1.3 The consequences of user experience

Whether the system use is mandatory or voluntary, it is important to understand the consequences of user experience. Frameworks for user experience that focus on the user-centered quality of interactive systems suggest that the subjective perception of product character or qualities (Hassenzahl, 2003; Mahlke et al., 2007) as well as emotional responses (Mahlke et al., 2007) influence future usage behavior (Hassenzahl, 2003; Mahlke et al., 2007) and overall judgment, preference, and satisfaction (Hartmann et al. 2008; Hassenzahl, 2003; Mahlke et al., 2007). According to Mahlke (2008) "*perceptions of instrumental and non-instrumental qualities as well as emotional user reactions determine the consequences of user experience*" and they "*incorporate the acceptance of the system and usage behavior*". Mahlke (2008) operationalizes consequences with overall judgments, choice between alternatives, and usage behavior. Hartmann et al. (2008) hypothesize that *"the outcomes of user's judgment are preferences between designs, intention to use, and the actual use (behavior)"*. Hassenzahl (2004) describes that *"using a product with a particular product character in a particular situation will lead to consequences, such as emotions (e.g., satisfaction, pleasure), explicit evaluations (i.e., judgments of appeal, beauty, goodness), or overt behavior (i.e., approach, avoidance)"*. However, the proposed causal relationships between the different constructs – that is, pragmatic and hedonic quality, and the overall judgments, such as beauty and goodness – are still under investigation (see e.g., Law et al. 2010; Hassenzahl et al.2010; van Schaik et al. 2012).

Satisfaction is a concept that is closely related to user experience and quality. Definitions of satisfaction emphasize not only the user's responses and attitudes towards the system or object but also the fulfillment of needs. One of the earliest definitions for computer user satisfaction proposes that *"satisfaction in a given situation is the sum of one's feelings or attitudes toward a variety of factors affecting that situation"* (Bailey et al. 1983) and that the factors are weighted by their importance to the individual in question (Wanous et al. 1972, as cited by Bailey et al.1983). On the other hand, satisfaction is defined in usability as *"freedom from discomfort and positive attitudes towards the use of the product"* (ISO 9241-11:1998). In the ISO standard for systems and software engineering, satisfaction is defined as the *"degree to which user needs are satisfied when a product or system is used in a specified context of use"*, noting that *"satisfaction is the user's response to interaction with the product or system, and includes attitudes towards use of the product"* (ISO/IEC 25010:2011).

Similarly, in IS research user satisfaction is viewed as the user's object-based attitude toward an information system (Wixom et al. 2005). Ajzen (2001) describes that attitude represents a summary evaluation of an object that arises from the beliefs in the objects. Beliefs associate the object with attributes and they can be captured with attributes such as good–bad, pleasant–unpleasant, likable–

dislikable (Ajzen, 2001). Satisfaction is related to an overall evaluative judgment of the system as an object-based attitude towards the object that may influence the user's behavior (Wixom et al., 2005). In the field of HCI, Jumisko-Pyykkö (2011) defines one characteristic of quality as *"an integrated set of perceptions of overall excellence"* referring to an overall evaluative judgment of quality based on the descriptive attributes that are verbally expressible distinctive features of quality.

Based on the presented prior literature, the consequences of user experience are determined by the perceptions of instrumental and non-instrumental qualities as well as the emotional user reactions. Consequences incorporate overall evaluative judgments, acceptance, usage behavior, and preferences, for example. For clarity, I use the concept of overall evaluative judgment instead of satisfaction in this thesis for the integrated set of user's impressions. Later in this thesis summary I discuss the quality of outcome of using the system as well as the perceived impacts of system use as having consequences for the overall evaluative judgments.

2.2 Models of user experience from the field of HCI

This section presents an overview of descriptive quality models related to user experience from the field of HCI (see also Jumisko-Pyykkö 2011, Mahlke 2008). The aim is to identify from the models the components of user experience, including the descriptive qualities as user experience components. The models from the field of IS that incorporate similar constructs or components as user experience models, but have also differing components relevant to this research, are reviewed in the next section.

The user experience components provide the theoretical background for the initial conceptual framework of user experience that was constructed in the beginning of the thesis work (see Figure 15). It is elaborated based on the empirical findings of the thesis work and presented in Chapter 5 (Figure 18). As the aim of the model created based on the synthesis of the thesis work is to provide support for developing and evaluating systems for mobile users that support mobile and cooperative work and crowdsourcing in mobile newsmaking, the approach in this thesis is primarily based on the user-centered component models of user experience and specifically focusing on quality-based models. Perceived quality refers to the user's subjective perception on an object's quality – or characteristic – whether the object is a system, an application, a mobile service, an outcome of usage of the system, or an impact of the adopted technology on the current situation or practices, for example. This thesis aims to identify the components of the descriptive qualities (attributes), the objects they are related to, and the factors that can contribute to the perceived descriptive qualities, in order to create a model of user experience based on earlier research and the empirical findings from the studies of the thesis.

Models chosen for the review have as common components of user experience 1) descriptive system or service related qualities, and 2) other experiential dimensions, such as emotional user reactions. In addition, they include 3) influencing factors, or antecedents, of the perceived quality or experience and/or 4) the consequences or outcomes of user experience. Some of the presented models are based on definitions, but they are included in this section to highlight the proposed and studied components of user experience.

2.2.1 The model of user experience by Hassenzahl and Tractinsky

One of the influential definitions for user experience in the field of HCI is presented by Hassenzahl and Tractinsky (2006): "*UX is a consequence of a user's internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g. organizational/social setting, meaningfulness of the activity, voluntariness of use, etc.).*" This definition emphasizes the characteristics of the user, system, and context as the factors that influence user experience. It has been illustrated by Roto (2006) (see Figure 2) and it illustrates the influencing factors. However, the model does not provide details on the components of user experience and the consequences of user experience.

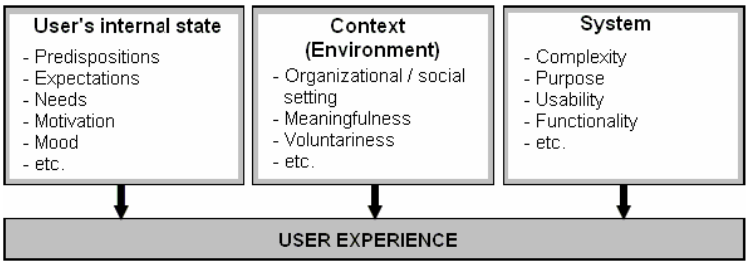

Figure 2. Illustration by Roto (2006, p. 26) for the definition of user experience presented by Hassenzahl and Tractinsky (2006) (reprinted with permission).

2.2.2 The model of user experience from the ISO standard

The standard for the Human-centered design of interactive systems (ISO 9241-210:2010) defines user experience as a *"person's perceptions and responses that result from the use/or anticipated use of a product, system or service"*. The definition emphasizes a broad and holistic view to user experience and describes the user's perceptions and responses as the manifestation of user experience. In addition, it highlights the temporal aspect relating to expectations prior to usage in addition to the experience based on the usage. The definition includes the following notes that aim to concretize the broad definition.

Note 1 describes the experiential components as follows: *"User experience includes all the users' emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviours and accomplishments that occur before, during and after use"*. This note highlights the multiple facets of user experience and the temporal dimensions of user experience. It also raises accomplishments as a component of user experience, being the only user experience model that can be interpreted to refer to what is concretely achieved as a result of the system usage.

Note 2 underlines the influencing factors: *"User experience is a consequence of brand image, presentation, functionality, system performance, interactive behavior and assistive capabilities of the interactive system, the user's internal and physical state resulting from prior experiences, attitudes, skills and personality, and the context of use."* This note emphasizes the features of the interactive system, the characteristics of the user, as well as generally the context of use as factors influencing user experience. These factors were also described in the previously presented definition by Hassenzahl and Tractinsky (2006).

Note 3 comments on the role of usability in relation to user experience: *"Usability, when interpreted from the perspective of the users' personal goals, can include the kind of perceptual and emotional aspects typically associated with user experience. Usability criteria can be used to assess aspects of user experience."* This addition is useful as it provides a comment on the debate between the similarity and difference between usability and user experience. It leaves it open for further research to investigate how usability and user experience are related. In addition, it remains somewhat unclear what is exactly meant by goals and whether they solely refer to instrumental goals in this case. Some of the models of user experience with quality-based approaches include usability related system qualities (attributes) in the models (Hassenzahl, 2003, 2004; Mahlke, 2008; Mahlke et al. 2007; Thüring et al. 2007).

As a summary, this definition for user experience emphasizes the following aspects:

- Experiential components: All users' perceptions and responses resulting from the use or anticipated use of a product, system, or service,
- The temporal aspect of experience: The temporal aspects of the user experience, before, during, and after the system use,
- Influencing factors: All factors that influence user experience, including the characteristics of the user, the interactive system, as well as the context of use, and
- Usability as a construct for system attributes that may influence user experience.

2.2.3 The model of user experience by Hassenzahl

Hassenzahl (2003, 2004) presents one of the first models for user experience that illustrates the product attributes as components of user experience (see Figure 3). According to Hassenzahl (2003, 2004), product character can be described by two attribute groups, namely pragmatic and hedonic attributes (Hassenzahl, 2003). Each person constructs his/her own personal version of the product character based on the product features and on her/his personal standards and expectations (Hassenzahl, 2003, 2004). Pragmatic qualities (attributes) are related to the product's usability and utility when the product is used for instrumental tasks and goals, and the user has a need to achieve behavioral goals (ibid.). On the contrary, hedonic qualities (attributes) are related to the user's self, such as stimulation and identification (ibid.).

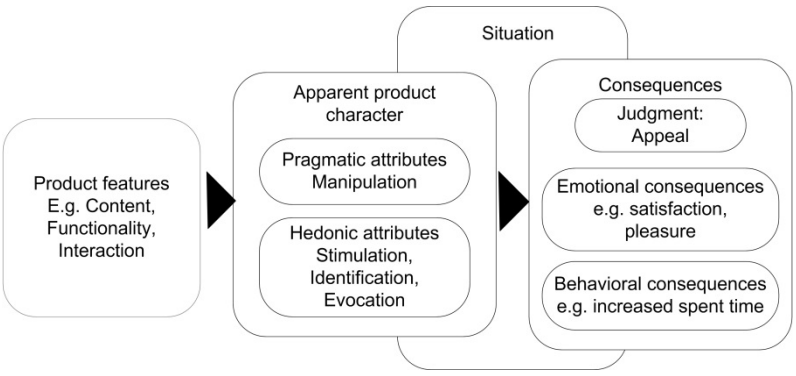

Figure 3. The key elements of Hassenzahl's model of user experience (Hassenzahl, 2003).

Hedonic quality focuses on the aspects of stimulation, identification, and evocation (Hassenzahl, 2003). *Stimulation* is related to personal development, that is, to curiosity, personal growth, the

development of skills, and the proliferation of knowledge (ibid.). *Identification* addresses the expression of self and the user's personal values to relevant others through objects and is therefore social (ibid.). *Evocation* refers to the product's ability to provoke memories, such as important past events or relationships (ibid.). According to Hassenzahl, the subjective perception of the product character leads to consequences, such as judgments about the product's appeal, goodness, and beauty (Hassenzahl 2003, 2004), as well as emotional and behavioral consequences. As examples of emotional consequences Hassenzahl discusses satisfaction and pleasure (ibid.).

The model presented by Hassenzahl was used in the beginning of this thesis work, jointly with some other models, to create an initial conceptual framework for user experience (see Figure 15) and as a basis in the evaluation of user experience in mobile newsmaking (P3, P4). Recent research based on the constructs of pragmatic and hedonic quality, beauty and goodness, investigates inference from overall judgments to pragmatic and hedonic qualities (van Schaik et al. 2012). Therefore, further studies are needed to establish the causal linkages.

2.2.4 The model for the components of user experience by Mahlke

A component-based model for user experience is presented by Mahlke (2008), Mahlke et al. (2007), and Thüring et al. (2007). The model is comprised of three main components (see Figure 4): 1) the influencing factors (system properties, user characteristics, context/task parameters), 2) three user experience components (the perception of instrumental qualities, the perception of non-instrumental qualities, emotional user reactions) and 3) the consequences of the user experience (overall judgments, choice between alternatives, usage behavior). The influencing factors related to system, user, and user's tasks and goals affect the perception of instrumental and non-instrumental qualities, and emotional user reactions are influenced in the user's interaction with the system. The user experience leads to consequences, including behavioral consequences.

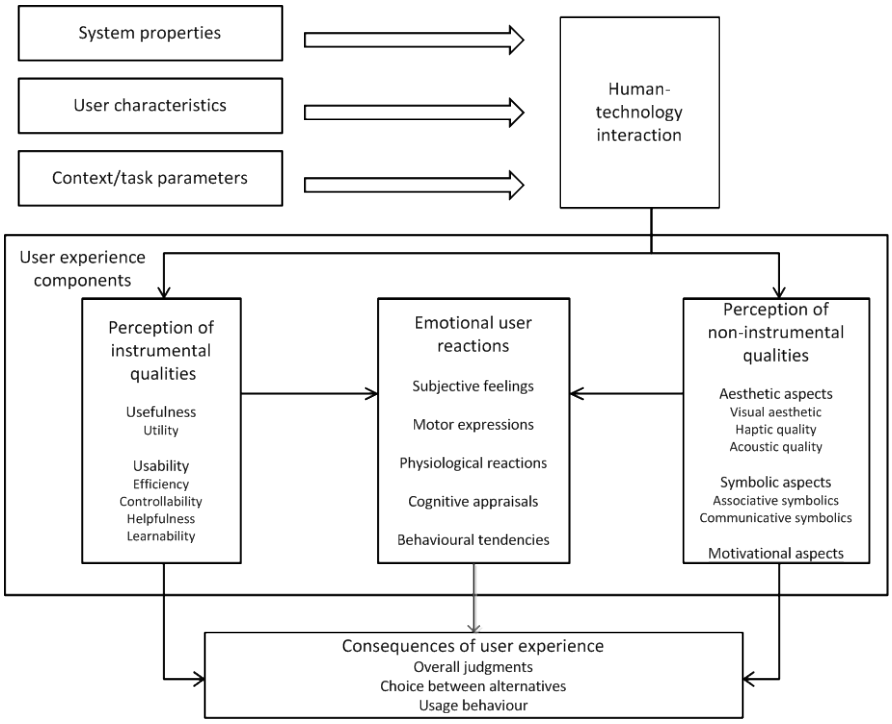

Figure 4. The components of user experience (Mahlke, 2008).

This model describes a holistic, generic framework for user experience components. It focuses on the perception of instrumental and non-instrumental qualities, and emotional user reactions as the user experience components. Emotional user reactions are components of user experience. It therefore differs from the model presented by Hassenzahl (2003) in which emotional consequences are a consequence of the perception of the product character. The model by Mahlke also separates the consequences of user experience from the components of user experience. This model provides the initial conceptual background jointly with the model by Hassenzahl (2003) for the model of user experience for mobile newsmaking with smartphones.

2.2.5 The model for mobile browsing user experience by Roto

Roto (2006) approaches user experience in mobile browsing with a product-centric view aimed at supporting user-centered design and development of solutions for mobile browsing. She presents a model for mobile browsing user experience with the components and attributes that are presented in Figure 5. This model highlights the characteristics of the user and the dimensions of context as factors influencing user experience. It provides a useful approach for breaking down the system to the system's sub-components (in this case; mobile device, browser, connection, gateway, sites) that influence the user experience. It presents the subcomponent related experiential aspects as attributes or qualities related to the subcomponents. The model support the user-centered design of solutions for mobile browsing, from identifying the characteristics of the context of use to the evaluation of the developed prototypes and solutions.

For this thesis, the user experience model of Roto provides support for illustrating and analyzing the system subcomponents and the related qualities that influence the user experience. This breakdown to subcomponent related qualities can be used for design and evaluation purposes.

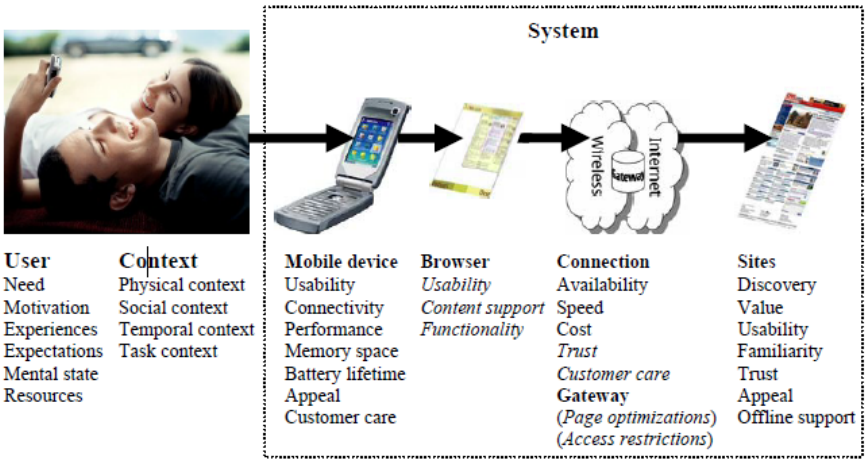

Figure 5. The characteristics of the mobile browsing user experience (Roto, 2006, p. 68, reprinted with permission).

2.2.6 The model of User-Centered Quality of Experience by Jumisko-Pyykkö

Jumisko-Pyykkö (2011) presents a model for quality of experience based on empirical studies for viewing experience of mobile television (see Figure 6). She defines User-Centered Quality of Experience as follows: *"User-Centered Quality of Experience is constructed in an active perceptual process where the characteristics of user, the system, and the context of use are contributing and its outcome is described by different experiential dimensions."*

The model has four main components: User, system, context of use, and experiential dimensions. The user is the person who actively perceives, i.e., controls and manipulates, a system (Jumisko-Pyykkö, 2011). In the case of mobile television, the system represents the characteristics of produced video quality that are categorized into three abstraction levels, namely, content, media, and network (ibid.). The context of use represents the circumstances in which the viewing takes place (ibid.). Finally, the experiential dimensions define the outcome of the perceptual process (ibid.). These include four dimensions: descriptive attributes (verbally expressible distinctive features of quality), excellence (preference of overall quality or its attributes), appropriateness to use (the relation of quality to the fulfillment of requirements for use), and psychophysiological influence (physiological automatic reactions to quality with a connection to psychologically interpretable phenomena) (ibid.).

Jumisko-Pyykkö (2011) describes three processes between the components represented by arrows in Figure 6). First, there is an active perceptual process between the user and the system in the context of use, where all these components contribute (Jumisko-Pyykkö, 2011). Second, an active learning process takes place between the user and the experiential dimensions (ibid.). An active adaptation and accommodation of the user's existing data structures takes place that influence the directing of the user's attention in quality perception (ibid.). The knowledge of experiential dimensions gained from user studies can be used in the development of system characteristics (ibid.).

Although this model specifically focuses on mobile television, it provides a step forward from the previously presented models to support further studies in the field of HCI on user experience when focus is on the descriptive qualities as outcome of user experience. The strength of the model is the clear distinction of the outcome of the perceptual process to four dimensions that includes descriptive attributes, excellence, appropriateness to use, and psychophysiological influence. This approach with the experiential dimensions, and specifically the quality perceptions (descriptive attributes), as an outcome of the perceptual processes related to user experience is adopted in this thesis work.

2.3 Models related to user experience from the field of IS

This section reviews models from the fields of IS with similar constructs or components as user experience models have. However, the presented models include constructs and components that provide support for the empirical findings of the thesis work and at the same time extend beyond the user experience models presented in the previous section. The models presented have been used in the thesis work as it progressed, in the iterative review of theoretical models as complementing, explanatory and rival theories for the emerging findings from the empirical research.

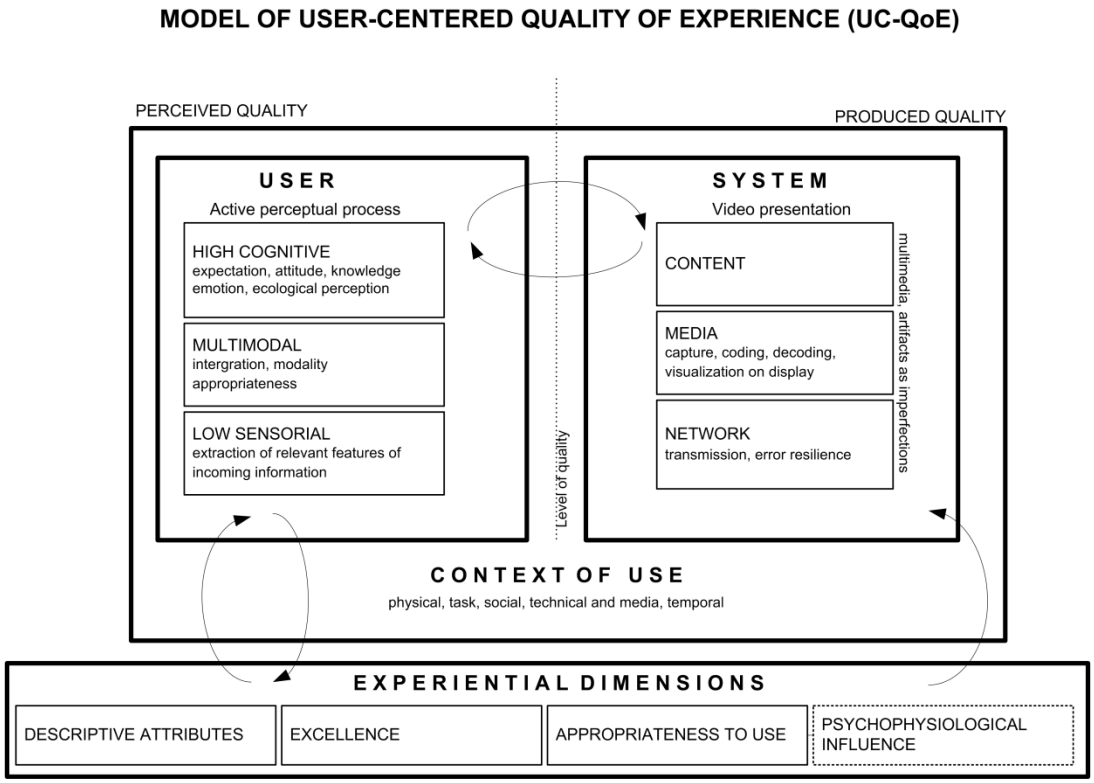

Figure 6. A model of User-Centered Quality of Experience for mobile television (Jumisko-Pyykkö, 2010, p. 64, reprinted with permission).

2.3.1 The technology acceptance model (TAM)

The technology acceptance model (TAM) is based on the assumption that individual reactions to using the technology determine an individual's attitude, that is, his/her intention to use a system (Davis 1989; Davis et al. 1989) as illustrated in Figure 7. Intentions have behavioral consequences on the actual system usage (Davis, 1989; Venkatesh et al. 2003). The TAM (Davis, 1989; Davis et al. 1989) is one of the most often used models from the field of IS that has been applied in the field of HCI to understand and identify factors that contribute to the acceptance of technology. Some of the constructs from the model have also been applied in user experience research (see e.g., Mahlke 2008; van Schaik et al. 2011).

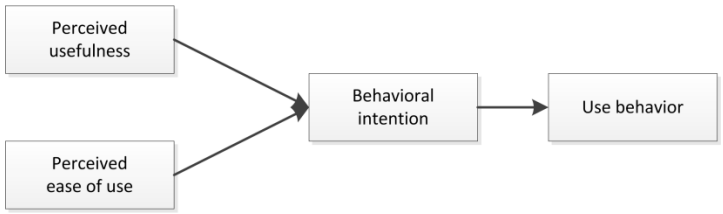

Figure 7. The technology acceptance model (Davis, 1989).

The user's acceptance of the system, i.e., how and when he/she uses the system, is influenced by two factors: Perceived usefulness and the perceived ease of use, which are utilitarian qualities of the system. Perceived usefulness is the degree to which a person believes that using the system enhances his or her job performance. The judgment is formed by comparing what the system is capable of

doing to what the user needs to get done with the system. The perceived ease-of-use is described as the degree to which a person believes that using a particular system would be free of effort.

Venkatesh et al. (2008) present an updated version of the TAM, called TAM3, aiming to provide support for managers to make informed decisions about IT implementations that can lead to enhancing employee's acceptance and effective use of IT. TAM3 is an integrated model of the determinants of the perceived usefulness and the perceived ease of use based on prior research. These determinants include individual differences (variables related to personality and/or demographics), system characteristics (the salient features of a system that can help individuals develop favorable or unfavorable perceptions regarding the usefulness or ease of use), social influence (various social processes and mechanisms that guide in the formulation of perceptions), and facilitating conditions (organizational support facilitating the use of IT).

The integrated model TAM3 proposes as the determinants of perceived usefulness the subjective norm, image, job relevance, output quality, result demonstrability, and perceived ease of use, as well as experience and voluntariness as moderators (Venkatesh et al. 2008). Regarding the perceived ease of use, the anchors for general beliefs about perceived ease of use that were suggested by Venkatesh (2000) include computer self-efficacy, computer anxiety, computer playfulness, and perceptions of external control (facilitating conditions). Two variables related to system characteristics, i.e., perceived enjoyment and objective usability, are suggested to function as adjustments for perceived ease of use (Venkatesh et al. 2008).

As the TAM was originally proposed for adoption of IS in organizational settings, it uses the perceived qualities (ease of use and usefulness) of system characteristics as the model components. In addition, as it has been widely applied in studies on mobile systems both in enterprise and consumer contexts, it is a relevant and interesting model for this thesis study. It includes several determinants for quality perceptions related to the used system that overlap with the influencing factors in previously presented models of user experience, as well as the experiential dimensions of system usage and the system's quality in use, presented in the previous subsection. A recent study (van Schaik et al. 2011) reports on web-based information retrieval with an integrated interaction-experience model that combines the TAM with the user experience model of Hassenzahl (2003, 2004). The study reports that the perceptions of perceived product qualities (pragmatic and hedonic quality) were independent determinants of beliefs (perceived ease of use, enjoyment, and usefulness, as well as intention to use), but evaluations (goodness, beauty) were dependent determinants of intention to use (van Schaik et al. 2011). The link between user experience and acceptance therefore deserves more attention.

The original TAM and its updated version TAM3 both provide links to the empirical findings of this thesis work. Specifically, the following determinants of perceived usefulness in TAM3 (Venkatesh et al. 2008) are interesting for this thesis.

- *Perceived ease of use*, is the degree to which a person believes that using an IT will be free of effort. This is important for any system used in a goal-oriented activity.

- *Subjective norm* refers to the degree to which an individual perceives that most people who are important to him/her think he/she should or should not use the system. These may include colleagues, other peers, or those present when using the system, for example.
- *Image* is the degree to which an individual perceives that the use of an innovation enhances his or her personal status in his or her social system (ibid). It relates to *Identification* in Hassenzahl's model of user experience (Hassenzahl, 2003).
- *Job relevance* is related to the degree of the applicability of the system to an individual's job. It resembles the notion of "appropriateness to use" which relates quality to the fulfillment of requirements to use (Jumisko-Pyykkö, 2010). Job relevance is relevant in newsmaking both for professional reporters as well as for reader reporters and crowdworkers.
- *Output quality* is the degree of the system to perform the individual's work tasks well as assessed by the worker. This construct has been used in studies for the communicativeness of the output, but also for the quality of reaching the goals.
- *Result demonstrability* is the degree of tangibility, observability and communicability of the results and consequences of using the system as believed by an individual. It is related to the perceived impacts, i.e., benefits and costs, which are discussed in the results in Chapter 5.

From the determinants of perceived ease of use especially one is present in the empirical findings in this thesis work. *Perceived enjoyment* refers to the extent of the activity of using the system to be enjoyable as such without taking into account performance consequences. In this research it seems to be connected to the enjoyment of the activity or sub-activites of newsmaking. The system may enable new type of activity and enable to develop new skills and express oneself creatively that was not possible before. On the other hand, for another individual, the usage of the same system may be frustrating due to the limitations of the system.

To conclude, technology acceptance models are relevant for this research when aiming at presenting a model for user experience. This is due to similarities of some constructs as well as extensions with novel components that are not present in the reviewed user experience models.

2.3.2 Delone and McLean's IS success model

In addition to TAM and itse extensions, the IS success model presented by Delone and McLean has been one of the most influential models in the field of IS research (DeLone et al. 1992). The original model, aiming to predict the success of IS, was based on a review of existing definitions for IS success and related measures (ibid.). Review results were categorized into six main components (ibid.). These categories include 1) system quality, 2) information quality, 3) use, 4) user satisfaction, 5) individual impact, and 6) organizational impact (ibid.).

Ten years later, Delone and McLean presented an updated model (DeLone et al. 2003). According to the updated model, a system can be evaluated based on information quality, system quality, and service quality (ibid.). The model suggests that the *characteristics of the system, service, and information qualities affect the intention to use or actual use, as well as user satisfaction* (ibid.). *System quality* refers to the desirable characteristics of an information system. Information quality refers to the desirable characteristics of the system outputs. *Service quality* is the quality of the support that system users receive from the IS department and IT support personnel. *System use* is the

degree and manner in which staff and customers utilize the capabilities of an information system. *User satisfaction* refers to the users' level of satisfaction with reports, web sites, and support services. *Net benefits* are the extent to which IS contribute to the success of individuals, groups, organizations, industries, and nations.

As a result of usage, net benefits are achieved that positively or negatively affect the intention to use or actual use of the system (DeLone et al. 2003). In the process sense, use must precede user satisfaction and in the causal sense, a positive experience from use leads to greater user satisfaction (ibid.). Based on a qualitative review of 180 articles of empirical studies that use the IS success model, Petter et al. (2008) report support for interrelationships between IS success constructs as depicted in Figure 8. The model provides a generic high-level model to approach evaluation of IS success and the main categories for the qualities of the IS solutions, as well as the net benefits as the consequences of the user's experience.

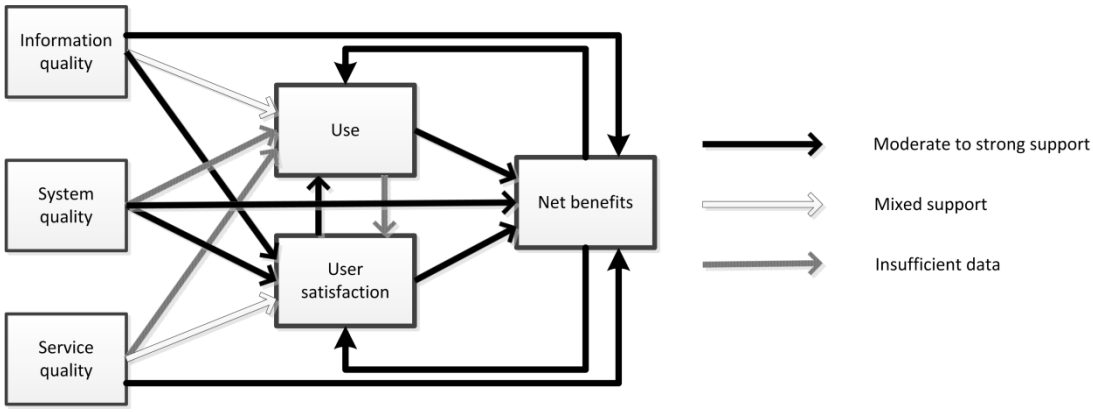

Figure 8. Support for interrelationships between IS success constructs at an individual level of analysis (Petter, DeLone, & McLean, 2008).

The IS success model (DeLone et al. 1992) and its updated version (DeLone et al. 2003, Petter et al. 2008) is useful for this thesis work as follows: It divides the system quality from the information quality the system provides and links these qualities to system use and user satisfaction. Furthermore, it includes the net benefits (an integrated assesment of benefits and costs) that can be positive or negative into the updated model. It connects them to use and user satisfaction with a feedback loop. This is the second of the presented models so far, in addition to the experiential component "appropriateness to use" in the model by Jumisko-Pyykkö (2010) from HCI and "job relevance" in TAM3 (Venkatesh et al. 2008), that considers the suitability of a system for the usage and its relationship to the behavioral or experiential level.

2.3.3 Task-technology fit model (TTF)

The task-technology fit (TTF) model focuses on the match between the user's task related requirements, individual abilities, and the available functionality of the technology (Goodhue et al. 1995). *TTF is the degree to which a technology assists an individual in performing his or her tasks* (ibid.). The model describes the technology-to-performance chain (TPC) where technologies lead to performance impacts at the individual level (ibid.). The proposed technology to performance chain includes the following constructs (see Figure 9): The antecedents of TTF (individual, task, and technology characteristics), utilization (the behavior of employing the technology in completing

tasks), the antecedents of utilization (the expected consequences of use, i.e., beliefs, affect, social norms, habits, facilitating conditions), and performance impact (the accomplishment of a portfolio of tasks by an individual in terms of efficiency, effectiveness, and output quality).

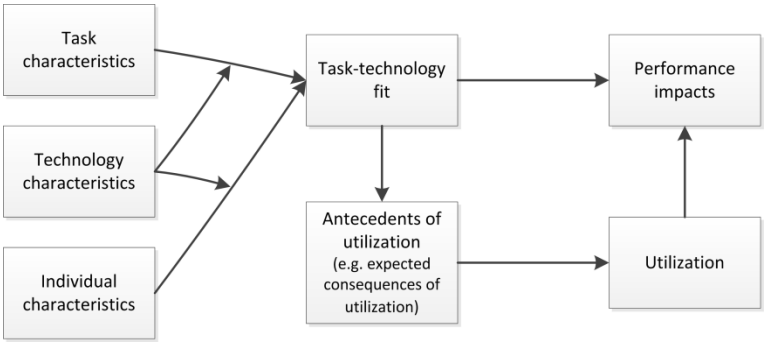

Figure 9. The proposed technology to performance chain (Goodhue & Thompson, 1995).

Goodhue et al. (1995) also discuss the feedback mechanism based on the actual experience of utilizing the technology. Actual experience may influence users perceptions of the impacts compared to what they anticipated and change the expected consequences and the future utilization. The TTF model has similar components to the TAM and IS success model. The overlap is discussed by Dishaw et al. (1999) and they propose an integration of the TAM and TTF model. A study using the integrated model that addresses the determinants of users' intention to adopt wireless technology in organizations reports that the intention to adopt was determined directly by the fit between the characteristics of task and technology as well as by the perceived ease of use and usefulness (Yen et al. 2010).

The TTF model is interesting for this thesis work due to the concept of TTF. As this concept explicitly refers to the degree that the technology assists one's activity, it addresses an important quality of the user's experience that may contribute to acceptance and future usage behavior.

2.3.4 An integrated model of user satisfaction and technology acceptance

Wixom et al. (2005) present an integrated model that distinguishes object-based beliefs and attitudes about the system from behavioral beliefs and attitudes about using the system. The integrated model combines the TAM (Davis, 1989) and the IS success model (DeLone et al. 1993). The motivation behind the integration is explained as follows (Wixom et al. 2005). The user satisfaction literature lists attributes that can be applied in system design and evaluation. However, based on earlier research, user satisfaction is a poor predictor of system usage (ibid.). The technology acceptance literature on the other hand predicts usage by linking behavior (system usage) to attitudes and beliefs (ease of use and usefulness) (ibid.). The integrated model aims to link the user satisfaction and technology acceptance literature to connect the design and implementation decisions to system characteristics and prediction of usage (ibid.).

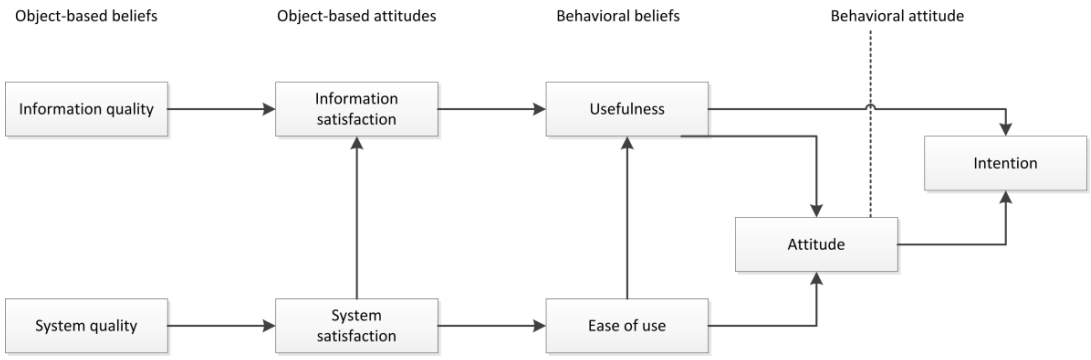

Figure 10. An integrated model of user satisfaction and technology acceptance (Wixom & Todd, 2005).

Wixom & Todd (2005) ground the model on the correspondence principle, which assumes that beliefs and attitudes about a specific behavior (e.g., using a smartphone), in a particular context (e.g., journalism), at a particular point in time (e.g., always / when nothing else is available / when convenient / when fast publishing is needed) are predictive of intention and behavior. The model is presented in Figure 10. When starting from the right-hand side of the integrated model, based on technology acceptance models, it proposes that 1) IT usage is driven by behavioral intention, 2) the attitude towards ease of use and usefulness determines intention, and 3) usefulness is a function of ease of use. Both usefulness and ease of use are assessments of the consequences of using a system to accomplish some task. Object-based attitudes are described to be external variables that may determine satisfaction with an object and the level of satisfaction may influence beliefs about the consequences of using the object.

The left-hand side of the model in Figure 10 is based on the user satisfaction literature. Wixom and Todd (2005) propose a set of antecedents based on earlier literature on information quality (completeness, accuracy, format, currency) and system quality (reliability, flexibility, integration, accessibility, timeliness). System quality related dimensions reflect perceptions of the system and how it delivers information (Wixom et al. 2005). The dimensions of information quality influence the user's perception of the system's quality of information (ibid.). The quality beliefs shape attitudes about system and information satisfaction (ibid.) and represent object-based attitudes. These attitudes influence the perception of usefulness and ease of use. The integrated model therefore combines the two original models (the TAM and the IS success model) to a causal chain. The empirical study conducted by Wixom et al. (2005) supports the proposed integrated model.

The integrated model is interesting for the current research as it includes descriptive qualities as model components and proposes a causal link from qualities to intention to use.

2.4 Summary

This chapter presented the key concepts related to quality-based models of user experience. Models of user experience from HCI as well as models from IS research were reviewed. In the beginning of the thesis work an initial conceptual quality-based framework for user experience was created based on selected user experience models from HCI to inform the research design of the first case study. The framework is presented in Figure 15 in the methods section in Chapter 4.2.1. As the

thesis work progressed and empirical findings emerged, theory and models were searched for that would provide explanations as well as work as rival theories for the findings. Models from IS research included components and constructs that complemented and explained some of the findings. The models from IS research that were most influential for this research were presented in this chapter. A summary of the reviewed models is presented next.

The candidates for *components of user experience*, from the previously presented models and definitions, are summarized in Table 3. From the nine summarized models and two definitions, the following main components of user experience can be identified. First, *the influencing factors* include 1) the characteristics of the user, 2) the characteristics of the system (or technology) and its sub-components, and 3) the context of use, including task characteristics. Second, *the experiential components* include 4) the perceptions of system, information, output, and service qualities 5) excellence, 6) emotional user reactions, and 7) fit or appropriateness to task or use. Third, *the consequences of user experience* in the models include 8) overall judgments (beauty, goodness) 9) satisfaction 10) attitude, 11) behavioral consequences (intention to use, actual usage, choice between alternatives), and 12) perceived net benefits and impacts.

Models and definitions from the field of HCI emphasize the characteristics of the user, system, and dimensions of context more often than the models from IS literature. All summarized models include perceived system qualities as experiential components as separate components or as groups of qualities. Emotional user reactions are included in the HCI models both as experiential components (Mahlke, 2008) and as the consequences of user experience (Hassenzahl 2003, 2004) – the latter naming satisfaction and pleasure as emotional consequences. In the included IS models (DeLone & McLean, 1992) user satisfaction is a consequence, namely, the level of the user's satisfaction with the system and its outputs that is affected by the system, information, and service qualities. In HCI models the consequences of user experience include overall judgments and behavioral consequences. Behavioral consequences are also included in the IS models.

For two of the models from the IS field, namely the TAM and the IS success model, there is a large amount of empirical evidence for the models and the causal relationships that can be drawn together to form evidence-based structural models. However, for the rest of the models, more studies are needed to be able to draw conclusions on the interrelationships between the constructs in the models, to build generalized structural models as well as to identify whether different application fields and contexts affect the models and their structure. Therefore, in HCI, more studies on user experience and the related constructs are needed in different application fields.

Although the summarized models and definitions cover a variety of influencing factors, experiential components, and consequences or outcomes, none of the models presented address the system as part of an activity within an ecosystem with processes and other parts, or as part of cooperative action. Furthermore, newsmaking aims to produce a tangible outcome (news material or news), which is used or consumed by others, in this case by an audience. This thesis aims to address this gap in organizational context in the specific case of mobile newsmaking.

The mobile systems in the context of mobile newsmaking are interconnected with a number of other systems and services as well as part of the collaborative activities of the people involved in the

newsmaking. On one hand this calls for a holistic understanding of the activity and its context and the practice studied. On the other hand it calls for a systematic breakdown of the system into sub-systems and their qualities and attributes. Understanding the characteristics of the components contributing to user experience and the experiential components is needed to support the user-centered design of the systems and in system evaluation.

Table 3. Summary of definitions and models for components of user experience from HCI and IS research.

Model or definition (Reference)	*Field of origin*	*Components*
User experience definition (Hassenzahl & Tractinsky, 2006)	HCI	Influencing factors: User's internal state; characteristics of the system; context (environment) within which the interaction occurs
User experience definition in the Standard for Human-centred design of interactive systems (ISO 9241-210:2010)	HCI	Experiential components: All user' perceptions and responses resulting from the use or anticipated use of a product, system, or service; Temporal dimension of user experience Influencing factors: The characteristics of the user and the interactive system; Context of use; Usability as a system attribute that may influence user experience
Hassenzahl's model of user experience (Hassenzahl, 2003 & 2004)	HCI	Experiential components: Product related pragmatic qualities/attributes (usability, utility); Product related hedonic qualities (stimulation, identification, evocation); Consequences: Judgments about the product's appeal, goodness and beauty; Emotional consequences (satisfaction, pleasure); Behavioral consequences (e.g. increased spent time)
Component model of user experience CUE (Mahlke & Thüring, 2007, Mahlke, 2008)	HCI	Influencing factors: System properties; user characteristics; Context/task parameters Experiential components: Perception of instrumental qualities; Perception of non-instrumental qualities; Emotional user reactions Consequences: Overall judgments; Choice between alternatives; Usage behavior.
Model for mobile browsing user experience (Roto, 2006)	HCI	Influencing factors: Characteristics of the user (needs, motivation, experiences, expectations, mental state, resources); Dimensions of context (physical, social, temporal, task); System and its sub-components (mobile device, browser, connection, gateway, sites) Experiential components: Qualities (attributes) of the system sub-components
Model for User-Centered Quality of Experience UC-QoE (Jumisko-Pyykkö, 2010)	HCI	Influencing factors: Characteristics of the user; Characteristics of the system; Context of use Experiential components: Descriptive attributes; Excellence; Appropriateness to use; Psychophysiological influence
Technology acceptance model (TAM; TAM2; TAM3) (Davis, 1989, Davis et al. 1989; Venkatesh et al. 2000; Venkatesh et al. 2008)	IS	Influencing factors: Individual differences; System characteristics; Social influence; Facilitating conditions. Experiential components (from original model): Perceived ease of use; Perceived usefulness Consequences: Behavioral intention; Use behavior Determinants of perceived usefulness: Perceived ease of use; Subjective norm; Image; Job relevance; Output quality; Result demonstrability Determinants of perceived ease of use: Computer self-efficacy; Perception of external control; Computer anxiety; Computer playfulness; Perceived enjoyment; Objective usability Moderators: Experience (for perceived usefulness and ease of use, behavioral intention), Voluntariness (for behavioral intention)
IS success model by DeLone and McLean (DeLone & McLean, 1992)	IS	Influencing factors: Characteristics of the system, information, and service qualities Consequences: Impact on use, and on user satisfaction, perceived net benefits (perceived net benefits positively or negatively affect the intention to use, actual usage and user satisfaction)
Task-technology fit model TTF (Goodhue & Thompson, 1995)	IS	Influencing factors: Characteristics of the individual, task and system Experiential components:Task-technology fit; performance impact (efficiency, effectiveness, output quality - these can be interpreted as qualities) Consequences: Utilization (behavior of using); Antecedents of utilization (expected consequences – beliefs, affect, social norms, habits, facilitating conditions)
Integrated model of user satisfaction and technology acceptance (Wixom &Todd, 2005)	IS	Influencing factors: Information quality (completeness, accuracy, format, currency); system quality (reliability, flexibility, integration, accessibility, timeliness) Experiential components: Information and system satisfaction; Perceived quality of interaction and use: Perceived ease of use and usefulness Consequences: Attitude; Intention

HCI = Human-Computer Interaction, IS = Information Systems

3. Mobile newsmaking

This chapter presents the background based on concepts and related literature on mobile work, mobile crowdsourcing, and mobile newsmaking in the context of online and print news.

3.1 Key concepts

First, the questions of *What is news?* and *What are news qualities?* are addressed. Next, notions of mobile newsmaking, mobile work, and cooperation are presented. Finally, notions of crowdsourcing and mobile crowdsourcing are discussed.

3.1.1 News and news qualities

The question "What is news?" has received a considerable amount of attention in journalism studies. It is a question of interest for this thesis, since the use of mobile, smartphone-based systems in newsmaking changes the newsmaking processes: how, when, and where news is made, as well as by whom. They also have impact on the types of news published as well as on the news qualities.

A dictionary definition defines news as *"newly received or noteworthy information, especially about recent events"* (Oxford Reference Online, retrieved 12.1.2014). The detection of what is news and newsworthy is described as relying on a journalist's *"feelings, thoughts and experiences"* (Itule & Anderson. 2007, p. 13) and it is referred to as a gut reaction (Sissons 2006, p. 24), news sense (O'Neill & Harcup 2008, p. 161), and a skill that evolves over time (Sissons 2006, p. 24). On the other hand, the selection of news is constrained and influenced by a number of structural factors, such as legal constraints, the system of media ownership, organizational routines, a shortage of time, and market forces (Harcup, 2009, pp. 17–34). Two types of news are usually referred to: 1) hard news and 2) soft news. *Hard news* is described as new, timely information about significant events, describing factual details of what has happened or what has been said (Itule & Anderson 2007, p. 12; Sissons, 2006, p. 24). *Soft news* is often characterized as lighter, more colorful and entertaining, and it may neither be immediately important nor informative (ibid.).

Harcup (2009, p. 55) summarizes what is news: "*News is a selective version of world events with a focus on that which is new and/or unusual. However, not all news is new; much of it is predictable, and some does not concern "events" at all. Journalists identify, select and produce news items according to occupational norms, including the concept of what will interest a particular audience. Implicitly or explicitly, journalists measure potential news items against a range of criteria that have become known as news values*". This description includes examples of criteria that journalists use in their decisions on what is newsworthy. Next these criteria are discussed in more detail.

Table 22 in Appendix 2 summarizes 22 news qualities (news values), i.e., **factors of newsworthiness**, based on two academic studies (Galtung & Ruge 1965; Harcup & O'Neill, 2001) and three introductory textbooks for journalism students with a practical viewpoint on newsmaking

(Itule & Anderson 2007, pp. 15–18; Sissons 2006, pp. 27–30; Smith 2007, pp. 13–19). These news qualities are discussed next.

The most often mentioned factors of newsworthiness, based on a number of sources mentioning them, are the *Scale* of the event, story or effect, *Relevance* for the audience, as well as *Eminence and prominence* referring to powerful and famous or noteworthy people, organizations or institutions. They are followed by *Timing* in relation to production timetable, *Unambiguity* for easy understanding, *Unexpectedness* in terms of rareness or surprise, *Follow-up* of headline news, *Composition and news agenda* in relation to the organization, publication or broadcast, *Human interest* referring to focusing on people and their actions, and *Negativity*. Furthermore, factors such as *Timeliness, Novelty, Availability, Acceptability, and Illustrations* are mentioned as deciding factors of newsworthiness. Further, Smith (2007) describes four common characteristics of news: 1) new to the audience, 2) true (or believed to be true), fair, and accurate, 3) about people, and 4) a trigger that provokes a reaction from the audience (Smith, 2007, pp. 13–16).

The presented factors of newsworthiness are not directly related to any technology. However, technology that is used in the newsmaking process can be an enabler or a hindrance when deciding the newsworthiness. Furthermore, used technology can have an effect on the news qualities. This is also the case for portable mobile technology, including mobile phones.

3.1.2 Mobile newsmaking

In this thesis, **mobile newsmaking** refers to the newsmaking activity that takes place in a mobile context of use by using mobile handheld technology, specifically smartphones, in one or several subactivities in the newsmaking process. The concept of mobile journalism has been characterized as "*the usage of handheld mobile multimedia devices in mobile context to retrieve, gather, capture, produce and/or edit as well as to wirelessly send and/or publish journalistic material, like text, photos, audio, video or their combinations. Ideally all the tasks would be performed with a single device*" (S4). The entire process of making and distributing a news story can be covered by one reporter directly on the spot of the event with mobile devices equipped with wireless connections (S1, S4). One reporter therefore can gather multiple media types with a mobile multimedia device and compile the story based on these materials with the device. Essentially the concepts of mobile newsmaking and mobile journalism cover similar subactivities, but the concept of mobile newsmaking is used in this thesis to provide a wider frame, focus on the activity of newsmaking, to include the cooperative aspects and related processes in the concept, as described in the next subsection.

Newsmaking is described as consisting of the following four main activities: 1) *discovering* the potential news item (Reich 2006), 2) *gathering* the news material (Bradshaw 2012; Reich 2006), 3) news *production* (Bradshaw 2012), and 4) *distribution* (Bradshaw 2012). These activities used to be sequential stages but are now often simultaneous (Bradshaw 2012). Figure 11 presents **a process model for the key tasks in mobile news reporting** (S1).

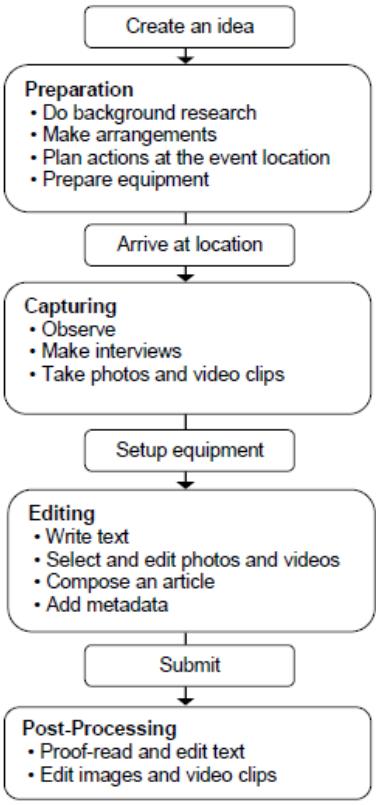

Figure 11. A process model of tasks in mobile news reporting (S1, reprinted with permission).

The following phases were carried out with smartphones: Preparation, Capturing, Editing, and Submission (S1). **Idea creation** was in this case primarily carried out collectively in the newsroom prior to the fieldwork, but also ad hoc reporting was carried out in the case something interesting was found (ibid.). The **Preparation** covers activities such as collecting background information about the topic and making the practical arrangements and plans (ibid.). These are carried out before the mobile journalist arrives at the location of the event to be reported on. In the **Capturing** (called gathering by Bradshaw [2012] and Reich [2007]), the journalist gathers source material for the article by, for example, interviews, and shooting photos and video footage (ibid.). In the **Editing** an article is composed based on the gathered information and source materials (ibid.). This involves writing the article text as well as selecting and editing the photos and video clips (ibid.). Finally, the **Post-Processing** is done by the editors in the newsroom to finalize the article for publication.

Similar models for news reporting tasks with slight differences in the model and the level of detail have been presented by Attfield et al. (2009), Forsberg (2001), Ho and Li (2005) and Sarjala (2010), for example. The model by Forsberg (2001) emphasizes the cooperative aspects of newsmaking in the early stages of planning the reporting (Figure 12). All in all, the key difference between mobile newsmaking and ordinary newsmaking is the use of mobile handheld technologies with wireless connectivity in various subactivities of the newsmaking process in the mobile context of use. Subactivities carried out with mobile phones include: audio, photo and video recording, navigation, information retrieval, synchronous and asynchronous communication by calling, email or instant messaging, note taking, collaboration and coordination through social media, and so forth.

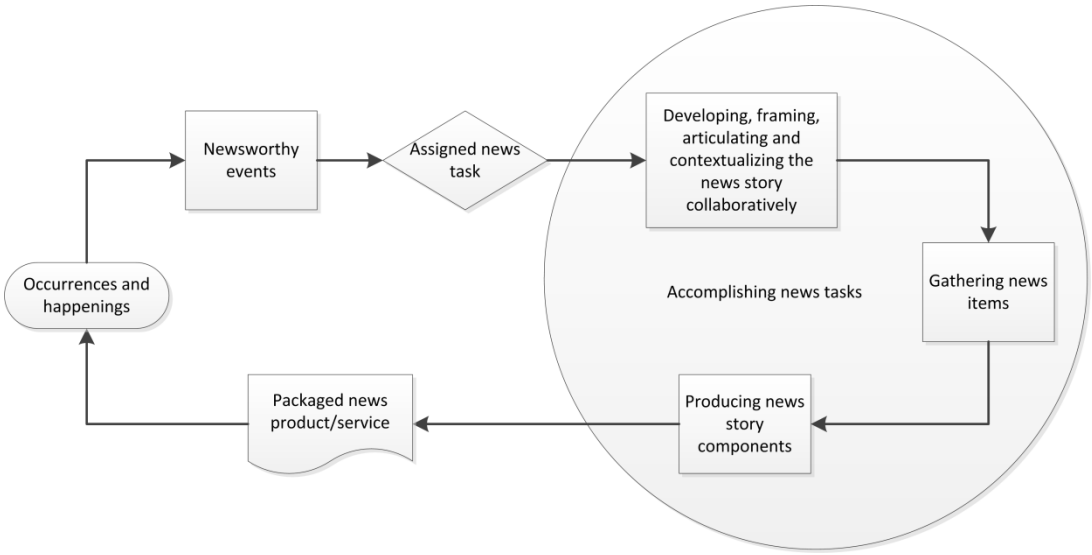

Figure 12. The newsmaking process, elaborated from the model by Forsberg (2001).

3.1.3 Mobile work

This section presents the key concepts related to mobile work. The concepts covered include mobile workers, mobile work, workplaces of mobile workers, mobile technology and the context of use.

3.1.3.1 Mobile workers

Andriessen and Vartiainen (2006, p. 6) define mobile workers as *"employees that work at and move between different places"*. In this thesis, mobile workers use mobile handheld technology, such as smartphones, in carrying out their goal and interest driven newsmaking related activities in the field. In this thesis, **mobile workers, i.e., users of mobile handheld tools (in this thesis smartphone-based systems) used in mobile newsmaking**, refer to

1) employees of the news organization (P6),

2) other professionals in the news industry, such as freelancers that work, for example, for the news organization on event based contracts (P6), or

3) mobile crowdworkers (Ross et al. 2010) or reader reporters, who carry out newsreporting related tasks based on the news organization's initiative with open, coordinated, or focused calls for content, expertise, or reports (Outing, 2005, P8).

I use a generic term "**mobile reporter**" or "**mobile journalist**" for the workers who are mobile and participate in news production in the newspaper industry, including writing journalists, news photographers, visual journalists, editors, reader reporters, and crowdworkers. Whenever a clear reference to a specific user group is needed, I use the name of that user group.

3.1.3.2 Mobile work

Mobile work is characterized by flexible use of time and place (Vartiainen & Hyrkkänen, 2010), that is, a person is able to move and carry out tasks "anytime and anywhere" (Perry et al. 2001; Vartiainen, 2006, p.14) with the help of wired or wireless technology (Vartiainen, 2006, p. 14).

Based on activity theory (e.g., Nardi, 1996; Kuutti, 1994; Kuutti & Arvonen, 1992), Vartiainen (2006) approaches mobile work as an activity system with the following elements (see Figure 13): a *subject* who uses *concrete and mental tools* to work on *objects* in a *working context* (Vartiainen, 2006, pp. 14–15). The subject as an actor can be a social or cultural entity, such as an individual, a pair, a group, or an organization (ibid.). The objects of work are determined by the self-set and given assignments, tasks, and goals (ibid.). According to Vartiainen (ibid.), "*activity systems are goal- and interest-driven entities, aiming to fulfill given or self-set tasks and assignments*" through purposeful actions. Activity theory provides a relevant viewpoint to understand the tool use, its role and its impact in its context of use, including the journalism practice.

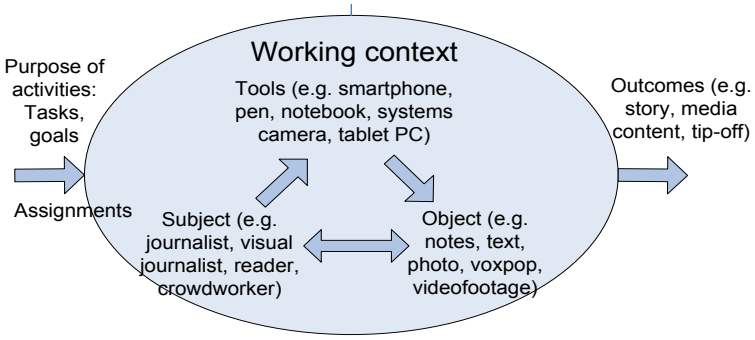

Figure 13. Mobile work as a work system (adapted from Vartiainen, 2006, p. 15).

In mobile newsmaking, **multiple workplaces** (Vartiainen, 2007) are characteristic of the activity. These multiple workplaces span from home or "office" (that is, the newsroom in the case of employees), to moving places (such as trains, busses, and airplanes) and to third workplaces (ibid.) that are used for short-term transitional stops (such as hallways and cafés). Based on the number of work locations and the frequency of changing the location Schaffers et al. (2006) describe four types of mobile and collaboration workplaces: (1) full mobility, (2) micro mobility, (3) multi-location, and (4) networked. **Full mobility** includes dynamic locations and a high frequency of changing worker locations (Schaffers et al., 2006), as in the case of mobile reporters.

3.1.3.3 Mobile technology

Vartiainen (2006, pp. 17–18) defines **mobile technology** (a concrete tool) as wireless technology, which includes mobiles, portable devices, and mobile services and applications. In this thesis the focus is on smartphones that can be connected to other components (such as external keyboards) and equipped with various services and applications as a form of mobile technology used as a multipurpose tool in mobile news production work. Merriam-Webster defines system as "*a regularly interacting or interdependent group of items forming a unified whole; a group of devices or artificial objects or an organization forming a network especially for distributing something or serving a common purpose*".

In this thesis **system** refers to a functional entity that, from the user's point of view, serves the newsmaking activity. It may be comprised of several physical product components with features and functionalities that receive information from and transmit information to other components (such as a

smartphone, an external keyboard, or an external screen) and of software components that may be installed to a physical component of the system as a standalone application with no network connectivity or as a mobile service client with network connectivity. In addition, the system interacts with other systems, such as editorial systems, and is therefore part of enterprise processes. Specifically, in this thesis the focus is on **mobile systems** that are based on smartphones as a central component and that are used for mobile newsmaking (see Section 3.1 for a definition of mobile newsmaking). In the context of journalism studies, Deuze (2008) describes the **role of technology** in the news industry as a facilitator for production arrangements and the management of creativity that *"extends and amplifies previous ways of doing things"*. On the other hand, a report by OECD (2010) identifies technology as radically changing how news is produced and diffused. I see mobile systems as one of the key technologies in this change.

3.1.3.4 The context of use

One of the influential elaborations on **context** in the field of HCI is presented by Dey (2001). Dey defines: "*Context is any information that can be used to characterise the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and application themselves*". Instead of interaction between a user and a system, Roto's definition of context (2006) emphasizes the circumstances of an activity: "*Context represents the circumstances under which the activity […] takes place*". Adapting the definition by Roto (2006), I see the mobile context of use as the *circumstances under which the activity of mobile newsmaking takes place*.

Based on an extensive literature review Jumisko-Pyykkö and Vainio (2011) identify five context components for a **mobile context of use**: 1) physical, 2) temporal, 3) task, 4) social, and 5) technical and information. In addition, they describe four subcomponents and properties: 1) magnitude, 2) dynamism, 3) patterns, and 4) the typical combinations of the previous points. Although the model is not focused on mobile work, the model includes elements that address the characteristics of the context of mobile work. I approach the mobile context of use to consist of components (dimensions in P6), subcomponents of these components, and properties (P6). They are relevant factors contributing to the user experience in mobile newsmaking.

In relation to the **characteristics of the journalistic work and its context**, Forsberg (1999) describes three important dimensions that influence the organization of editorial work. The first dimension is **time**, which refers to, for example, time-critical work, in which deadlines and daily meeting cycles affect the pace of the work. The second dimension is the **content**, referring to the different media types and publishing forms as well as the resources for and organization of the production of the content. The third dimension is the **context**, where the logical perspective covers basic values, domains, and policies, and the physical perspective, which covers the structure, type of the story, form, layout, and so forth. Furthermore, Deuze (2008) describes journalistic work as creative, time-dependent, and on one hand relying on the individual's professional skill and autonomy and on the other hand being a collective effort. Context characteristics described by

Forsberg (1999) and Deuze (2008) can be mapped to previously mentioned context components, subcomponents, and their properties.

3.1.4 Cooperation

Newsmaking is typically described as a collective activity of professionals working in a news organization (Bellotti & Rogers 1997; Deuze 2008; Fagrell & Ljungberg 2000; Forsberg 2001; Ho & Li 2005; Kensing et al.1998). More recently, descriptions of the newsmaking process also involve readers as networked collaborators (Beckett, 2010; Beckett & Mansell, 2008; Singer et al., 2011).

Cooperative activity with a common goal, such as news reporting, that is carried out in distributed locations with synchronous or asynchronous communication, is characterized by the "*need for communication, planning, coordinating tasks, monitoring project progress, and cooperation*" (Neale et al. 2004). Neale et al. (2004) use the concept of work coupling when defining the demand for information sharing or the level of communication required. Loosely coupled work requires few interactions, whereas tightly coupled work requires frequent communication (Neale et al., 2004). The quality of communication is important for the quality of the outcome when carrying out the tasks (ibid.). Five levels of work coupling are described (ibid.):

1) Lightweight interaction – casual social interaction and communication about the work
2) Information sharing – unidirectional or in inform–acknowledge pairs
3) Coordination – of both activities and communication, i.e., of the content of the work and the process of carrying out the work; characterized by processes, procedures, tasks, tools, and awareness: includes planning, scheduling, assembling and managing resources, task allocation (roles), alignment, monitoring task and activity states, information sharing, and managing interpersonal relationships
4) Collaboration – working towards a common goal; group members perform separate tasks with high interdependence, but individually
5) Cooperation – demands the greatest amount and highest quality of communication; people have shared tasks and they are committed to team effort; the team's priorities are put over individual's goals.

All of the described levels include communication, that is, the exchange of information between people (Busbach, 1996). According to Neale et al. (2004), in the evaluation of CSCW systems the following factors need to be taken into account: individual cognitive factors, cooperative and collaborative factors, usability issues for individuals and groups, the social and organizational impact, and the larger context that situates the other factors. It is proposed that maintaining awareness of the social, temporal, activity, and spatial context is important in successful cooperation in goal-oriented activities (Carroll et al. 2003; Neale et al., 2004; Bardram & Hansen, 2010).

This thesis work addresses both the individual reporters' views of newsmaking with smartphones as well as the cooperative issues in mobile newsmaking in the case of **mobile and location-based assignments**. By mobile assignments I refer in this thesis to news briefings sent to, or accessible with, a mobile handheld device, such as a smartphone (adapted from P7). By location-based assignments I refer to news briefings sent to, or accessible with, a mobile handheld device, such as a smartphone, based on the reporter's location (adapted from P9) that is discoverable by wireless

locating solutions such as GPS, Wi-Fi, or base station information. Systems addressing tasks in mobile work in the field of HCI have used notions such as personal attentive user interface systems (Streefkerk et al. 2006), context-aware notification systems (Steefkerk et al. 2007), and location-based notification systems (Steefkerk et al. 2008) in the case of police officers, as well as context-aware notification systems in the case of firefighters (Jiang et al. 2004), mobile reporting systems in the case of road maintenance workers (Ahtinen et al. 2007) and to-do lists for mobile workers (Perry & Brodie 2006). In this thesis summary I use the notions of a mobile journalism system or mobile news reporting system, as the system studied covers not only mobile assignment related processes, but also the mobile news reporting activity with various tasks, subactivities, and cooperative aspects.

Participatory journalism is one of the concepts that is used to describe readers as collaborators in newsmaking that is facilitated by a news organization (Singer et al., 2011). The cooperation of readers with the newsroom can be categorized into three levels as presented in the case of citizen science projects (Bonney et al., 2009): 1) *contribution* of content, 2) *collaboration,* in which readers are asked to perform certain tasks or share their expertise and views in the form of crowdsourcing, and 3) *co-creation* in which readers and newsroom staff work as equals in different phases of the newsmaking process (P9). The notion of cooperative activity, both in case of professionals and readers as mobile reporters, calls for taking into account not only the news story related tasks and the technology as a tool for carrying out the reporting related tasks but also the processes in the newsmaking activity and in the cooperation.

3.1.5 Crowdsourcing

Crowdsourcing can be seen as a novel form of work (Kittur et al., 2013; Ross et al., 2010; Silberman et al., 2010). **Crowdsourcing** means that *problems or tasks that need solving are distributed to a crowd to be completed,* referring to the outsourcing of tasks to a crowd (Howe 2006, 2008). In addition to crowdsourcing and outsourcing, the definition by Merriam-Webster emphasizes also the medium, the Internet, as a way to reach the crowd: "*the practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people and especially from the online community rather than from traditional employees or suppliers*".

Based on a literature review, Estellés-Arolas & González-Ladrón-de-Guevara (2012) list **three key elements of crowdsourcing: 1) the crowd** (who it is formed of, what it has to do, what it gets in return), **2) the initiator**, i.e., the crowdsourcer (who it is, what they get in return for the work of the crowd), and **3) the process** (the type of process, the type of call used, the medium used). They propose the following definition for crowdsourcing: "*Crowdsourcing is a type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task. The undertaking of the task, of variable complexity and modularity, and in which the crowd should participate bringing their work, money, knowledge and/or experience, always entails mutual benefit. The user will receive the satisfaction of a given type of need, be it economic, social recognition, self-esteem, or the development of individual skills, while the crowdsourcer will obtain and utilize to their advantage that what the user has brought to the venture, whose form will depend on the type of activity undertaken*."

The definition by Estellés-Arolas et al. (2012) provides a comprehensive coverage of the **characteristics** of the crowdsourcing activity: 1) a defined crowd, 2) a task with a goal, 3) a stated recompense for the crowd, 4) an identified initiator (crowdsourcer, seeker), 5) defined compensation for the initiator (crowdsourcer), 6) an online assigned participative process, 7) an open call of variable extent, and 8) use of the Internet as the technical implementation supporting the activity. These characteristics need to be addressed when designing crowdsourcing processes and developing technology for it.

3.1.6 Mobile crowdsourcing

Mobile crowdsourcing in this thesis is defined as follows: "*the initiator sends a task or makes available a task for voluntary undertaking by using smartphones as an enabler for receiving or accessing the assignments, as a tool for carrying out the activity or for submitting the contribution*" (adapted from Väätäjä et al. 2013). **Location-based crowdsourcing** refers to a specific type of mobile crowdsourcing, in which "*the initiator (news organization) sends a task or makes available a task based on the participant's (reader's) mobile phone location (location-based assignment, LBA) for voluntary undertaking using smartphones as an enabler for participation*" (P9). In this thesis neither the recompense for the crowdworker, i.e., the reader, nor the benefit for the initiator (the media company) are in the primary focus of the research, although they are important factors and motivators in crowdsourcing processes.

As in crowdsourcing, in the mobile crowdsourcing of news the tasks may be 1) *open calls* for anyone to participate in and contribute to the activity (Howe 2006, 2008; Whitla, 2009), 2) *limited calls to a community with specific knowledge and expertise* (Whitla, 2009), or 3) *a combination of the previous* with an open call, but participation is limited (Whitla, 2009). In the case of crowdsourced news content created by readers, two types of calls have been described (P8): 1) *coordinated calls* to the crowd for certain content (like photos on a certain topic) that are requested by the media organization, and 2) *focused calls*, commissions or assignments for content to one or several readers based on their profile (such as equipment, interests, hobbies, or knowledge), specific expertise, or geographic location. Similarly to professionals carrying out mobile news reporting with smartphones, the readers or crowdworkers may use a smartphone not only for receiving or searching for tasks and submitting content but also for the gathering and editing of the material or other subactivities in the newsmaking process.

Although systems for mobile crowdsourcing have been proposed in research literature, such as in the earliest implementations like *txteagle* (Eagle, 2009), *Askus* (Konomi et al., 2009), and *mCrowd* (Yan et al. 2009) (for more recent examples see Chatzimilioudis et al., 2012), only a few studies consider the mobile user's viewpoint in mobile crowdsourcing. Alt et al. (2010) report on users' preferences and patterns for participating in mobile crowdsourcing with location-based task retrieval and location-based assignments. The study addressed the following dimensions of preferences and patterns: task type (picture, informative, and action), time-criticality, validity, patterns of searching for tasks, patterns of solving (time, location, vicinity to location), incentive, as well as search area vs. location when searching. In this study, picture tasks (taking a photo) and informative tasks (collecting information) were favored over action tasks (doing something – e.g., buying, calling,

doing a favor). Temporally constrained tasks and tasks without monetary incentive were not favored. The maximum time people were willing to spend when solving a task was 10 minutes. Searching for tasks was done during midday breaks, and they were solved after work. Users preferred searching for tasks close to their current proximity.

Even though user studies addressing user experience in mobile crowdsourcing are rare, in practice news publishers are increasingly using their own (e.g., CNN) or third party (e.g., Scoopshot) dedicated mobile clients, or alternatively using social media services (e.g., Twitter, Facebook) to distribute tasks and receive contributions. Often they are used to reach the audience in the case of eyewitness news – that is, user-generated content on breaking topics, such as riots, disasters, and accidents, that can be used by the newsrooms. Mobile crowdsourcing platforms such as Jana enable to reach large amount of people with mobile phones equipped with simple browsers in developing countries to participate in surveys by news publishers such as CNN (journalism.co.uk online). In addition, solutions to support news reporting by identifying breaking news in the newsrooms from social media have been proposed (e.g., Diakopoulos et al. 2012).

3.2 Related work on factors contributing to usage and user experience in mobile work

This subsection briefly summarizes the related work on factors that contribute to usage and user experience of mobile handheld technology, as well as the positive and negative impacts of using mobile handheld technology in mobile work. Prior research on mobile, handheld devices, such as mobile phones, as well as the mobile services used on mobile devices, has identified a number of elements contributing to usability and user experience. These elements are often categorized by three main elements, namely: the user, the mobile context and system, the product or service (e.g., Jumisko-Pyykkö 2010; Roto 2006). This categorization is used in the following summary of related work. In addition, the type of effects of using ´mobile systems in mobile work that are discussed in prior research in the fields of HCI and IS are presented.

3.2.1 The user

User characteristics that contribute to usage and user experience have been studied widely in the case of mobile consumer products and they are exemplified here with a few examples. For mobile phone use and adoption, Sarker and Wells (2003) report that demographics (age), technology related skills (technological self-efficacy) and culture (cultural origin) were the most important factors influencing use and acceptance. In the case of mobile browsing, Roto (2006) reports the mobile user related characteristics that affect the user experience to be: need, motivation, experiences, expectations, mental state, and resources. As user related factors that can contribute to the quality of experience in the case of viewing mobile television Jumisko-Pyykkö (2011, p. 50) summarizes the following: the user's relationship to the content, knowledge about digital quality, attitude towards technology, and age.

In the case of mobile work, HCI studies that report on the relationship of user characteristics and usage, or user experience, are rare. This may be due to the fact that studies on mobile work in HCI

are often carried out in the field as qualitative studies with interviews or observations as data gathering methods (see e.g., Pascoe et al., 2000; Perry et al., 2001). Furthermore, in field studies, the number of participants is often relatively low and it is not possible to control the participant characteristics or it is not in the focus of the studies (see e.g., Karlson et al. 2010). This hinders the making of conclusions on relationships between user characteristics and usage or user experience of mobile technology.

On the other hand, in IS research, some quantitative studies using questionnaires as a data collection method report on user characteristics that affect the acceptance and fit of mobile technology to tasks. Yi et al. (2006) studied the acceptance of mobile handheld devices, that is, PDAs (Personal Digital Assistants), by physicians in hospitals and found that Personal Innovativeness in IT (PIIT) had a significant effect on the Perceived Ease of Use, Result Demonstrability, the Subjective Norm and Perceived Behavioral Control. The findings by Wu et al. (2011) in a study carried out with hospital professionals (physicians and nurses) somewhat differ from the previous result: PIIT is not significant in determining Attitude, but it is a significant determinant of the Perceived Ease of Use and Perceived Behavioral Control. When studying the fit between PDAs and insurance tasks, Lee et al. (2007) found that gender and age did not have a significant effect on any of the studied task-technology fit (TTF) constructs (Data Quality, Data Locatability, Authorization, Timeliness, Compatibility, Systems Reliability, Ease of Use / Training, and Relationship with Users). In contrast, Position Experience, Cognitive Style and Computer Self-efficacy were found to be the major factors for predicting the fit.

As a summary for mobile work, technology attitude or PIIT may influence the perception of mobile system qualities in mobile work, such as Ease of Use, as well as attitudes towards technology. PIIT may also be related to Perceived Behavioral Control. Position experience, Cognitive style, and Computer self-efficacy can be related to TTF constructs, whereas gender and age have not been shown to influence TTF in mobile work. In addition, it can be hypothesized that knowledge about digital quality of media content in relation to the news material as well as user role may contribute to user experience in mobile newsmaking.

3.2.2 The system

Table 4 illustrates mobile technology related issues that have been addressed in earlier literature to contribute to usage and user experience in a mobile context. The listed features and related characteristics are often referred to as critical factors that need to be taken into account when designing for mobile systems and for mobile work. Small display size, cumbersome and error-prone data entry, slow speed, unavailability and unreliability of wireless connections, and short battery life have often been reported as barriers and limiting factors in mobile use. In addition, functionalities are reported to affect use, the perceived fit to task, or acceptance (e.g., Gebauer 2008; Gebauer & Ginsburg 2009; Sawyer & Tapia 2005).

Table 4. Examples of the features of mobile handheld systems and their characteristics that that have been reported to affect usage and user experience in mobile work.

Feature	Characteristic	Reference(s)
Display	Size, resolution	Gebauer & Ginsburg (2009) Kristoffersen & Ljungberg (1999) Zhang & Adipat (2005)
Data entry	Numeric keypad, keyboard, small buttons and labels, multimodality, touch, stylus, handwriting recognition	Gebauer & Ginsburg (2009) Kristoffersen & Ljungberg (1999) Pascoe et al. (2000) Straus et al. (2010) Zhang & Adipat (2005)
Form factor	Size, weight, sturdiness, robustness, fits into pocket, ruggedness	Gebauer & Ginsburg (2009) Pascoe et al. (2000) Straus et al. (2010)
Connectivity	Network access and reception, bandwidth and coverage, switching from Wi-Fi to GPRS, speed, availability and reliability of connections	Gebauer (2008) Kristoffersen & Ljungberg (1999) Pascoe et al. (2000) Straus et al. (2010) Sørensen et al. (2004) Zhang & Adipat (2005)
Performance	Processing or computational capacity	Zhang & Adipat (2005)
Battery	Life	Gebauer & Ginsburg (2009) Pascoe et al. (2000) Sørensen et al. (2004)
Ergonomics	Environmental conditions, multi-tasking	Straus et al. (2010)
Security	Information transmission, system lockouts, authentication	Sawyer & Tapia (2005) Straus et al. (2010)
Interoperability	Multipart systems, multiple devices	Oulasvirta & Sumari (2007) Sørensen et al. (2004)

As a recent example of studies on smartphone use in mobile work, Straus et al. (2010) studied the effectiveness of mobile wireless communication technologies for law enforcement teams. They identified the following advantages of smartphones: device portability, unobtrusiveness, and multi-functionality. Multi-functionality was appreciated as participants found it undesirable to carry several multiple devices when on foot surveillance. The greatest perceived limitation in using smartphones was system lockout or a need to reauthenticate every 30 minutes. This impeded communication in operations as well as access to information in time-critical situations. It was considered to be risky for a user to disengage from the situation at hand to enter a password. In addition, device ergonomics were perceived as a limitation since users were working around the clock in a variety of environmental conditions and they were frequently multi-tasking.

Gebauer (2008) reports that perceived technology maturity and system quality (in terms of technology performance) can explain and predict satisfaction, use, and performance impacts. The availability of technology in different types of use contexts, portability in terms of size, weight, and battery life as well as the availability of service independent of location was emphasized. Communication and productivity related functionality appeared to be of most value, especially in support of non-routine and supervisory task profiles.

To conclude, mobile handheld systems have limitations due to the physical form factor of the device that may contribute to user experience. These limitations include display size, data input, and battery life. On the other hand, unobtrusiveness when used, multi-functionality as well as availability, and the reliability and speed of wireless connections are important for user experience in a mobile context of use. Although the form factor creates limitations, the portability of mobile systems is

highly dependent on it, which can be one of the perceived strengths of mobile systems. Furthermore, technological maturity seems to be an important factor that influences user experience.

3.2.3 The context of use

This subsection aims to provide an overview of context characteristics that have been addressed in related work. Similarly to user related characteristics, literature on mobile work provides relatively few empirical results on the characteristics of context that contribute to usage and user experience. This may be due to the fact that mobile work inherently takes place in the mobile context of use. Mobile context characteristics vary significantly and the primary focus of the studies has not been on identifying context characteristics that contribute to user experience or usage.

Table 5 summarizes examples from previous literature on characteristics that have been mentioned in relation to a mobile context of use. Characteristics are categorized based on context dimensions presented by Jumisko-Pyykkö & Vainio (2010). Task, temporal, physical, as well as technological and information dimensions seem to have been addressed in the literature of mobile work, whereas the social context has received relatively little attention.

In general, usage of mobile handheld devices in a mobile context of use is characterized by distractions, interruptions, and fragmented attention (Karlson et al., 2010; Kristofferson & Ljungberg, 1999; Pascoe et al., 2000; Oulasvirta et al. 2005). Distracting characteristics of the mobile context of use, such as reflections on the screen and parallel tasks, that may influence experienced quality have been reported in the case of the experienced audiovisual quality of 3D mobile television (Jumisko-Pyykkö & Utriainen, 2010). The split visual resources when interacting with the mobile devices (tapping with a stylus on a PDA) and walking, simultaneously trying to maintain an awareness of the environment, have been shown to increase the task completion times, error rates, and work load, as well as reduce walking speed (Lin et al. 2007).

In relation to task context, the task hierarchy and task characteristics are important. The primary task, such as observing animals (Pascoe et al., 2000) or focusing attention on other tasks external to the mobile device: to avoid danger, to monitor progress, or to handle other objects (Kristoffersen & Ljungberg, 1999), may call for a high level of attention and limit the use of hands for interaction with the mobile device. Multi-tasking, such as communicating on the phone while pursuing a target in police work, splits the attention of the user (Straus et al., 2010). The fragmented attention caused by context characteristics, including interruptions (physical context), parallel tasks, multi-tasking, and the handling of other objects related to the task at hand, is therefore one of the issues that needs to be considered when designing for a mobile context of use in mobile work.

The characteristics of temporal context seem to be emphasized in mobile work. Time-criticality, urgency, deadlines, and time-pressure have been especially emphasized in related work. In the case of freelance work, the hours of work are described as unpredictable and extended (Sadler et al.,2006). In addition, the available time span for carrying out the work tasks is mentioned. The physical context characteristics include environmental conditions, location, and dynamism of the environment, as well as interruptions caused by traffic lights. In relation to the technology and information context, related work repeatedly refers to available technology and information and the uncertainty related to them in a mobile context of work, or alternatively sees them as a strength in

mobile work. Finally, in relation to social context, bystanders affect the comfort of using mobile systems, as users consider whether bystanders experiencing the use of the system is appropriate to the situation. This was the case when incident commanders recorded video footage in the case of a fire (Bergstrand et al., 2011). Also, in the case of police work, unobtrusiveness and discreteness were considered when using smartphones (Straus et al., 2010).

Table 5. Examples of the characteristics of the mobile context of use for mobile work based on related literature.

Dimension	Characteristic	Reference(s)
Task	Parallel primary task	Bergstrand et al. (2011) Kristoffersen & Ljungberg (1999)
	Multi-tasking	Straus et al. (2010)
	Handling of other physical objects simultaneously	Kristoffersen & Ljungberg (1999)
	Evolving tasks based on locality and situation	Fagrell et al. (2000)
	Task complexity, irregularity	Yuan & Zheng, (2009) Gebauer (2008) Gebauer et al. (2010)
	Task interdependence	Yuan & Zheng, (2009)
	Work in dead time, in transit, in waiting	Perry et al. (2001)
Temporal	Available time span	Perry et al. (2001) Karlson et al. (2010)
	Time-criticality, time-pressure, deadlines, urgency	Bergstrand et al. 2011 Chatterjee et al. (2009) Fagrell et al. (2000) Gebauer et al. (2010) Straus et al. (2010) Streefkerk et al. (2010) Yuan & Zheng, (2009, 2010)
	Time of day	Straus et al. (2010)
	Hours of work – extended & unpredictable	Sadler et al. (2006)
Physical	Environmental conditions	Straus et al. (2010)
	Location	Sadler et al. (2006)
	Dynamic environment	Pascoe et al. (2000)
	Interruptions	Karlson et al. (2010) Sadler et al. (2006)
	Location dependence of the task	Yuan & Zheng, (2009) Yuan et al. (2010)
	Frequency of mobility	Yuan & Zheng, (2009)
Social	Bystanders	Bergstrand et al. (2011) Straus et al. (2010)
Technology and information	Available technology and access to information	Perry et al. (2001) Sørensen et al. (2004) Sadler et al. (2006)

3.2.4 The effects of using mobile systems in mobile work

Examples of the positive and negative effects of mobile technology from previous literature (see also e.g., Sørensen et al., 2008; Vuolle, 2011; York & Pendharkar, 2004) are listed in Table 6. As can be seen, a wide variety of positive effects for mobile workers are reported in the related work. On the other hand, negative effects have also been described, for example, due to technical constraints, limitations in the implementation or being available at all times.

In the case of the police using smartphones in their fieldwork (Straus et al., 2010), the most often mentioned positive impacts were convenience, timeliness, and flexibility, leading to increased efficiency and effectiveness. Somewhat surprisingly, most users had a positive attitude to the blurring of the distinction between their professional and personal lives that the used technology required. They found it valuable to be able to react flexibly and independently of time to important situations during off-hours. However, some users were concerned about the unwanted intrusion and added workload that resulted from increased accessibility.

All in all, the use of mobile systems in mobile work from an organizational perspective usually aims for increased productivity, whereas from the point of the users, the impacts may be both positive and negative. The trade-off between these perceived positive and negative impacts seems to be related to user experience and overall evaluative judgments of system quality.

Table 6. Examples of the positive and negative effects of mobile technology in mobile work (P6).

Type of effect	*Effect*	*Example(s)*	*Source(s)*
Positive	Time savings	Less unnecessary travel, e.g., to and from the office, direct data input at location	Perry et al. (2001) Standing et al. (2008) Verburg et al. (2006) Pascoe et al. (2000)
	Effective use of dead-time	While waiting, commuting	Perry et al. (2001) Straus et al. (2010)
	Speed of working	Data recording at a faster speed	Pascoe et al. (2000)
	Access to data	Independence of time and place to access documents and information	Perry et al. (2001) Straus et al. (2010) Vuolle (2011)
	Speed of access to databases	Speeds up, fewer steps, fewer errors	Straus et al. (2010)
	Situation and activity awareness	Understanding overall situation, keeping up with the activities of colleagues	Bergstrand et al. (2011) Streefkerk et al. (2009, 2010) Vuolle (2011)
	Decision making	Supports, speeds up, fewer errors	Bergstrand et al. (2011) Gebauer et al. (2004) Streefkerk et al. (2009)
	Communication	Improved mediated support, either synchronously or asynchronously, sharing information and updates, discrete communication via email	Gebauer (2008) Sørensen et al. (2004) Standing et al. (2008), Straus et al. (2010)
	Coordination	Coordination of activities with team members in changing situations	Straus et al. (2010)
	Workload	Reduction of the overall workload	Perry et al. (2001) Sheng et al. (2005)
	Knowledge sharing	Improvement within and outside the organization	Fagrell et al. (2000) Forsberg (2001) Sheng et al. (2005) Vuolle (2011)
	Informing of and coordinating availability	For work opportunities in freelance work	Sadler et al. (2008)
	Management of relationships and networks	Being available and managing relations to clients, peers, and loved ones	Sadler et al. (2008)
	Data accuracy	Able to collect and store data in the field, more data can be collected	Pascoe et al. (2000) Standing et al. (2008) Vuolle (2011)
	Decision accuracy	Fewer errors	Streefkerk et al. (2009)
	Resource and task allocation	More efficient distribution of the workload	Perry et al. (2001) Streefkerk et al. (2009)
	Being “on call” 24h a day	Email is a less disruptive way of contact than a phone call	Straus et al. (2010)
	Safety	Being able to account for the whereabouts of others when needed	Straus et al. (2010)
Negative	Demand for extra attention in use	Technical limitations or problems such as battery running out, interruptions	Sørensen et al. (2008)
	Decision errors	Increase due to the mismatch of real and system context, incorrect advice	Streefkerk et al. (2010)
	Longer response time	Increase due to the mismatch of real and system context, incorrect advice	Streefkerk et al. (2010)
	Cognitive overhead	More team communication	Streefkerk et al. (2010)
	Miscommunication	Limitations of technology, incorrect advice	Streefkerk et al. (2010) York et al. (2004)
	Ergonomics	Limitations of technology	York et al. (2004)
	Work–family balance	Increased stress from being available at all times	Vartiainen (2006)
	Social situations	Offensiveness of prioritizing calls over immediate company	Sadler (2008)
	Loss of control	Lowered user satisfaction in mandatory use	Lee & Park (2008)

3.3 Prior research on mobile newsmaking

There exists relatively little research in HCI on the fieldwork and mobility of news reporters or on user experience of mobile tools in mobile newsmaking. Most of the research on journalistic work conducted in newspapers or in radio or TV broadcasts focuses on the work and production related

processes in the newsroom. These studies call for supporting management, communication, collaboration in or coordination of the work, or for supporting a specific phase of the process (Attfield, et al. 2003, 2008, 2009; Diakopoulos et al., 2012; Engström et al., 2010; Helle, 2000; Ho & Li, 2005; Kensing et al., 1998; Markkula & Sormunen 2006; Westman & Oittinen, 2006). Only a few studies on journalistic work address the mobility of the reporters (professionals, readers, or crowdworkers), the use of mobile tools, or the needs and requirements for the design of mobile tools for mobile newsmaking. I present next an overview of the related work on mobile newsmaking that focuses on the viewpoint of a mobile reporter.

3.3.1 Support for mobility and time-savings

Bellotti and Rogers (1997) report a field study on the changing practices of publishing companies when publishing both in print and online. They are the first to identify and address the mobility of the workers as one of the characteristics of multimedia publishing (Bellotti et al., 1997). They (ibid.) describe 1) micro-mobility (Schaffers et al., 2006) within the office when collaborating and communicating with others in the publishing activity, 2) full mobility (Schaffers et al., 2006), when reporters need to travel long distances to gather news, as well as 3) multi-location work, when editors have meetings outside the office with different stakeholders. Bellotti et al. (1997) propose handheld devices as potential tools for taking notes, for example, while making interviews with pen-based devices. According to their findings, reporters emphasize that the used tools should not be intrusive in the interview situations – tools such as laptops were found to be intrusive with the clicking keys and the screen between the interviewee and the reporter. Tools should allow eye contact with the interviewee when used by the reporter. Bellotti et al. suggested to journalists a pen-based handheld note taking solution.

The work by Bellotti et al. (1997) identifies two requirements for system qualities: non-intrusiveness and eye-free use. The benefit that was strived for by suggesting support by using hand-held mobile devices in note taking was time savings when writing up the story.

3.3.2 Support for knowledge sharing in journalistic fieldwork

Fagrell et al. studied the work of news journalists at a radio station with an ethnographic approach in order to explore how reporters went about solving their news reporting tasks to support their fieldwork (Fagrell et al., 2000a; Fagrell et al. 2000b; Fagrell et al. 2000c). Based on the findings they developed a knowledge management solution for journalism called NewsMate that could be used on mobile palmtop devices, specifically on PDAs (Personal Digital Assistants) (Fagrell et al. 2000a). They later also introduced a generalized solution and architecture called FieldWise for PDAs to support fieldwork in other fields, such as for service electricians, sales, and real estate brokering (Fagrell et al. 2000b).

The solution for journalism developed by Fagrell et al. focuses on supporting knowledge sharing in the early phases of the newsmaking process when preparing news items (Fagrell et al. 2000c). Two main tasks were identified in the preparation phase: 1) exploring – investigating potential news items and initiating them, and 2) elaborating – researching and framing the initiated news items to report them (ibid.). These tasks were found to be cooperative and collective (ibid.). The initial

implications for the design of knowledge management systems are the following (ibid.): 1) provide easy access to surveys of archives based on the work item in focus, 2) support finding expertise by attaching authors to all information, 3) provide easy access to the available authors of information, especially field reporters, 4) support the journalists in keeping each other informed about the (evolving and new) work tasks, and 5) provide new information based on the (evolving) items journalists are working on.

The field evaluation of NewsMate was carried out with 50 hours of evaluative ethnography with ten journalists (Fagrell, 2000). While journalists were carrying out their news reporting tasks, they were confronted with the results of the NewsMate presented by the researcher who was shadowing their work (ibid.). The tips from internal archives and external sources were judged to be interesting and provide new viewpoints to consider on how to report an event and what to include in the interview questions (ibid.). In the case of reporting breaking news, where preplanning and searching for background information prior to working in the field is limited, the information from the internal archives and external sources was found to be helpful (ibid.). In addition, when a journalist was uneasy about their own expertise on the topic to be reported, the possibility of finding colleagues with relevant expertise was appreciated in order to ensure the high quality of the reporting (ibid.). Furthermore, the notification of available updated information on the topic being reported would help in carrying out the reporting on the spot (ibid.). Overall, the benefits and usefulness of the solution and its features are therefore dependent on the situation at hand and the type of reporting task in question. Furthermore, in some cases the solution was perceived to have an impact on how the reporting is done as well as on the quality of the reporting.

The presented solution supports the first phases of the reporting, such as planning and framing the reporting, but it does not focus on the later stages, specifically editing, submission, or broadcasting of the news material with the PDA.

3.3.3 Need for ease of use and fast connectivity

Quinn (2002, pp. 139–154) discusses the opportunities of using mobile technology in journalism. He describes, as the key benefits of mobile technology, the enabling of the virtual newsroom. It allows reporters to be on the road more, less bound to their desks, and at the same time to spend more time in the community. It also allows the transfer of files seamlessly to the editors in the newsroom with the approaching deadline when reporting breaking news. Quinn also emphasizes the need for supporting the coordination of the work of the reporters in the field as the story unfolds, as well as supporting quick and clear communication between the team members in the newsroom and in the field. A note-taking tool is requested, as earlier suggested by Bellotti et al. (1997), that should be simple and easy to use. Inspired by the FieldWise implementation developed by Fagrell et al. (2000b), Quinn calls for supporting a) locating available expertise, b) mobile access to news archives, and c) helping filter unnecessary data. As general requirements for mobile tools Quinn states two qualities: ease of use and fast connection speeds.

3.3.4 Technical quality as a critical issue when producing mobile news videos

Hickey et al. (2007) carried out a study on producing news videos with smartphones for two web magazines. The goal of the study was to understand the usefulness of the used technology in journalists' work. Five reporters from a student magazine that was being published at a web reporter course and four volunteer reporters of a web magazine for foreigners participated in the study. Participants used a Nokia 7710 smartphone with a 1 megapixel camera and the capability for recording audio and video clips as well as for capturing photos. The captured material was transferred to a personal computer for post-processing and publishing. The study resulted in two published videos, one in each magazine, and one photo was published.

The primary reason for the low number of published multimedia was that the participants perceived the quality of the videos to be too low for web publishing. Participants also wished for a zoom and other adjustments for recording. In-phone video editing tools were requested to overcome the need for transferring the files to the computer and thus to save time in order to be able to meet the deadlines. Participants also felt that the video recording needed their full attention, hindering carrying out other tasks such as interviewing simultaneously. However, the phone was found to be generally easy to handle and record videos with.

The audio quality in noisy environments was described as poor. However, participants expressed that they could use a smartphone as a voice recorder rather than a video recorder. As a benefit they expressed that a phone placed on a table for voice recording enabled them to work freely during the interview and write down the story based on the voice recording after the interview. This seems to refer to the issue described by Bellotti and Rogers (1997) on journalistic work, that is, the requirement for the non-intrusiveness of the tool. In addition, being able to focus on the interview as the primary task at hand when using the phone as a voice recorder is raised to be important for the journalist's work in the findings, as already mentioned for video recording by Hickey et al. (2007).

Even though the participants were not satisfied with the outcome of the smartphone usage for news video capture, specifically, the quality of the captured video footage, the benefits of smartphones were also acknowledged. Some of the participants saw that mobile video could be useful for journalism, especially when no other option for recording is available to capture a newsworthy event in ad hoc situations. In addition, the device is always brought along. As a further benefit it was mentioned that a smartphone combines three work tools (a voice recorder, a camera, and a video recorder) into one work tool.

Overall, the study by Hickey et al. (2007) underlines that the technical quality of the captured audio and video footage is a critical factor for the mobile reporters. Technical features and functionalities requested by the participants covered capturing and editing related issues, including a zoom, other adjustments for video capture, as well as an in-phone editing tool to facilitate editing the material on the phone directly, aiming for time savings by removing the need to transfer files to a PC. The acceptable situations for using a smartphone for capturing video footage were ad hoc reporting situations, when no other device is present for recording. The identified benefits of smartphones were ease of use and that it is always brought along and therefore available. In addition, a smartphone was found useful for audio recording an interview. On the other hand, it was felt to be intrusive and to

hinder the focus of the reporter on the primary task, that is, the interview, i.e., when carrying out a video interview while simultaneously video recording it with a smartphone. Important qualities of the work tool are therefore non-intrusiveness in a social situation and enabling the journalist to focus on the primary task.

3.4 Summary

User experience in mobile newsmaking is influenced by the characteristics of the user, system, and the context of use. The user in the role of the mobile reporter in this research is approached as a mobile worker, as is also the case in crowdsourcing and reader participation. The mobile system is part of the mobile newsmaking process; being an enabler that supports the activity in a mobile context of use. The mobile system may be used in a variety of subactivites of mobile newsmaking and therefore has a multipurpose role.

As a smartphone-based system is used as a multipurpose tool in mobile newsmaking, the focus shifts from the narrower perspective of user experience when using it to carry out a single task to a wider perspective. Focus is on the activity of mobile newsmaking, user experience and the impacts of using the mobile tool for the user, journalism practice, news content, the type and qualities of published news, and finally the audience and its experience.

This raises the following subquestions for this thesis: What are the characteristics of the mobile reporters, mobile systems and the context of use that contribute to user experience in mobile newsmaking? What contributes to the evaluative judgments of smartphones in mobile newsmaking? What are the impacts of using smartphones in mobile newsmaking?

The review of the related work on mobile work revealed that the focus is on the mobile system related features and functionalities, either as limiting factors, barriers for using, or supporting, new work practices. In addition, the characteristics of mobility and mobile context of use, as well as the benefits and costs (positive and negative effects) of using mobile systems, were considered in the literature. The frequently studied system related qualities are perceived ease of use, perceived usefulness and perceived fit to task due to grounding the studies in IS literature. Only a few studies present empirical results from field studies on the user or context related characteristics or system features and functionalities that contribute to the evaluative judgments of systems in mobile work.

The review on mobile newsmaking related literature revealed the following issues. The motivation to use mobile systems was having a makeshift for ad-hoc reporting situations (Hickey et al. 2007. The study by Fagrell et al. (2000b) suggests that access to information in the field (internal archives, external sources) may impact how to report an event due to the new viewpoints available as well as by giving ideas as to what to include in the interview questions. This also supports ad hoc reporting situations, where the preplanning of reporting prior to entering the field is not possible or is limited (Fagrell et al. 2000a). Access to the expertise of colleagues and the status of their availability may contribute to a higher quality of reporting if the journalist covering the story is not an expert on the topic in hand (ibid.). Updates to the information related to the task being carried out were also perceived to help in reporting from the spot of the event (ibid.).

The desired mobile system qualities for mobile newsmaking mentioned in the related work are:

- *non-intrusiveness* in social situations, such as when interviewing (Bellotti et al. 1997, Hickey et al. 2007),
- *ease of use* (Hickey et al. 2007; Quinn 2002),
- *availability* of the tool as always carried along (Hickey et al. 2007),
- *speedy connectivity* (Quinn 2002).

Mobile system related features and functionalities that were identified to influence user experience were 1) adjustments of settings and zoom for multimedia capture (Hickey et al. 2007) 2) the form factor (size, weight) (Hickey et al. 2007), 3) the video editor (Hickey et al. 2007) as well as 4) interoperability with the newsroom systems, archives, and external information sources (Fagrell et al. 2000; Hickey et al. 2007),.

Both positive and negative impacts of smartphone usage were identified in mobile newsmkaing. For example, the small size and light weight of a smartphone were perceived as a benefit (Hickey et al. 2007). A cost was lower technical quality of the audio and video footage compared to that captured and edited with other tools, which were compared to the journalistic quality of the publication in question (Hickey et al 2007).

Appropriateness to use in mobile newsmaking seems to depend on 1) the mobile system and its features and functionalities, 2) the situation and 3) the type of reporting task in question. Specifically the quality of reporting seems important for professional reporters. The lower technical quality of the captured media is acceptable in the case of breaking news and ad hoc reporting situations (Dinka et al. 2006; Hickey et al. 2007). Requirements for a mobile system include: 1) nonintrusiveness of using the system and support for eye-free use such as in interview situations when taking notes (Bellotti et al. 1997, Hickey et al 2007), 2) ease of use and fast connection speeds (Quinn 2002), 3) technical quality of the audio, photo, and video footage is a critical factor for appropriateness for mobile newsmaking that are evaluated based on the situation (Hickey et al. 2007), 4) support for note-taking to create time-savings when writing up the story (Bellotti et al. 1997), 5) zoom and manual adjustments for video capture as well as possibility to edit videos on the device to create time-savings (Hickey et al. 2007), 6) mobile access to archives and information (Fagrell et al. 2000, Hickey et al. 2007) and enabling the focus on the primary task, such as in the case of interviewing (Bellotti et al. 1997, Hickey et al. 2007).

To summarize, earlier literature on mobile newsmaking presents needs and requirements for the mobile system and its qualities. Perceptions as evaluative judgments of system qualities seem to depend on 1) the mobile system and its features and functionalities, 2) on the situation at hand, 3) the type of reporting task in question, and 4) on the quality of the captured news items. These issues are addressed in-depth in this thesis, to create a holistic understanding of user experience in mobile newsmaking.

4. Research approach and methods

This section first describes the methodological choices of this research including the research approach and process. It then describes shortly the research methods and gives an overview of the empirical studies of this thesis. In addition, a description is given of the data collection in the field and how the collected data was analyzed.

4.1 The research approach

The purpose of this thesis is to gain a holistic understanding of user experience in mobile newsmaking with smartphones. The thesis seeks explanations for participant perceptions and judgments, and why the identified influencing factors, components of user experience, and perceived impacts emerge when using smartphones in mobile newsmaking.

This thesis work rests on pragmatism, which aims to understand, interpret, and explain the existing links between things and their interdependencies for practical ends (Maxcy, 2003). Pragmatism is a practical research philosophy that fits the applied research approach. Reality is assumed to be embedded in the experience and actions of an individual in the real world context (ibid.). When choosing methods, the research question, understanding the problem, and the purpose of the research are considered to be more important than the method or the paradigm underlying the method (Maxcy, 2003; Teddlie & Tashakkori, 2003). Often both qualitative and quantitative methods are applied (ibid.). The research process is typically cyclical rather than linear (ibid.). In this thesis work, the research process is iterative applying abductive reasoning with phases for exploring, understanding, visiting theory and related work for reflection, explanation building and interpreting.

A case study approach was chosen to collect rich, in-depth data from real-life use in a mobile context to understand user experience as a phenomenon within the context of newsmaking (Stake, 2000; Yin, 2003, p. 13). Yin (2003, p. 13) defines the scope of a case study as follows: "*A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly defined*". In case study research the researcher explores a case bounded by time and activity: a system, event, activity, process, community, organization, or one or more individuals (Creswell, 2007, p. 73; Creswell, 2009, p. 13; Yin, 2003, pp. 22–26). Using a case study as a research approach is especially appropriate for examining complex phenomena (Klein & Myers, 1999) and processes (Gephart, 2004). The individual case studies of this thesis are instrumental (Stake, 2000), aiming to facilitate understanding of user experience, mobile newsmaking, technology usage, and development needs, as well as the impacts of smartphone-based technology and processes on the newspaper industry.

Thesis work employed an abductive case study approach in which a) the existing theoretical frameworks and empirical findings of the thesis work are linked throughout the research process and b) the theoretical frameworks evolve based on the empirical findings (Dubois & Gadde, 2002; Dubois & Gibbert, 2010). Multiple single case studies were used to provide a description and create a

holistic understanding of the phenomenon within its context as well as to provide explanations for the findings (Yin 2003, pp. 39–53). The cases were selected based on finding as representative as possible participants and contexts for carrying out the research (Eisenhardt, 1989). When selecting the cases, the maturity of the mobile service clients was taken into account. The trialed technology was still at the level of a functional prototype that could have usability issues of varying severity.

Theory (Yin 2003, pp. 28–33) – in this research taking the form of conceptual frameworks and prior related literature, including prior empirical findings (Carroll & Swatman, 2000; Eisenhardt, 1989; Miles & Huberman, 1994, pp. 18–22) – was used in creating a pre-understanding of the phenomenon and studied field. Theory and related literature was revisited and explored iteratively throughout the thesis work in the planning of the research designs for the case studies as well as when building explanations for and interpreting the findings.

A within case analysis was conducted for each case study (Eisenhardt, 1989; Miles et al., 1994) with a data-driven content analysis, as described later. A cross-case synthesis (Yin, 2003, p. 133–137) was carried out for publication P6. For the thesis summary, the findings presented in publications were classified and in some instances the primary data was revisited to support the classification. A theory-informed approach was used in this classification aiming for constructing a user experience model for mobile newsmaking. Similarly, the process model for mobile assignment-based processes was created based on analysis of the findings related to mobile processes.

Table 7. The tests and tactics of this research for dealing with the quality of the case study research (adapted from Dubois & Gibbert 2010; Eisenhardt, 1989; Yin 2003, p. 34).

Test	*Description*	*Case study tactics used in this research*	**Phase of the tactic**
Construct validity	The extent to which a study investigates what it claims to investigate, i.e., the extent to which a procedure leads to an accurate observation of reality	Use of multiple sources of evidence (i.e., data) – data triangulation	Data collection & analysis
		Use of different data collection strategies	Data collection
		Establishing a chain of evidence	Data collection & analysis
		Findings, draft reports, and publications reviewed by journalism experts, peer reviewers, or other researchers involved in the study	Data collection Composition
Internal validity	Make inferences based on the available evidence (logical validity)	The formulation of the research framework	Research design
		Pattern matching to predicted patterns or established patterns in previous studies	Data analysis
		Theory triangulation to address rival explanations	Data analysis
		Several researchers involved in the data analysis when resouces available – investigator triangulation	Data analysis
External validity	Establishing a domain to which findings can be generalized (generalizability)	Analytical generalization from empirical observations to a broader theory	Research design
		Multiple-case study approach	Research design
		Cross-case synthesis	Data analysis
Reliability	Demonstrate that the operations of the study can be repeated; the absence of random error	Transparency by documentation and clarification of the research procedures by creating a case study protocol	Data collection
		Replication by the development of a case study database for notes, documents, and other data	Data collection

Table 7 presents the four tests (construct validity, internal validity, external validity, and reliability) for the quality of the research when using the case study approach (Dubois & Gibbert 2010; Eisenhardt, 1989; Yin, 2003, pp. 33–39) and the tactics chosen in this research to deal with them. The research design used theory and prior literature to create an initial conceptual framework. As findings emerged, the theory was revisited to search for rival explanations and refine the

theoretical framework. Multiple single case studies were carried out to strengthen the generalizability of the findings beyond a single case study. In the data collection phase most of the studies collected evidence from at least two sources of data, the used concepts and measures were based on theory and prior empirical findings and the studies used a case study protocol that was created with stated objectives and background theory, data collection procedure and forms, a plan for documentation and reporting, and the specific questions to be answered. In addition, a case study database was developed for each case study. Each database contains the case study protocol, raw data (recorded and transcribed interviews, transcribed field notes, questionnaire responses, captured photos, and video clips), other collected artifacts from the study, analysis memos, analyzed data, related literature, and reports and publications. Throughout the research, the process of understanding the phenomenon and context jointly with explanation building, was iterated between the findings from the single case studies and the theory. Finally, in the phase of writing up the findings as reports and publications, the findings were reviewed by experts in the area of journalism, peer reviewers, or by other researchers that were involved in carrying out the research.

The research approach of the thesis is primarily qualitative. Combinations of qualitative and quantitative strands were used in the studies with varying timing, weighting, and mixing of the strands (Creswell et al. 2003; Creswell et al. 2008) (see Table 8). The emphasis on qualitative research stems from the goal of understanding the explored phenomenon and technology usage in a natural setting, aiming to find explanations and provide interpretations inductively from multiple sources of data and from multiple perspectives in order to establish patterns and themes (Creswell, 2007, p. 37). Mixed methods research designs (Creswell & Plano Clark, 2007; Tashakkori & Teddlie, 2003) with qualitative and quantitative strands were used to complement, corroborate and/or expand the findings from the other strand of the study in this thesis (Tashakkori & Teddlie, 2008). Mixed methods research designs provided a more comprehensive and more complete account of the area of the research and understanding of the context, enabling finding explanations for the findings and instrument development, as well as augmenting the findings of one strand by the other strand (Bryman, 2008b).

Seven of the case studies were carried out as field studies, two (studies 8 & 12) as quasi-experiments in field conditions, two as interview studies and one as a participatory focus group. Field studies were chosen for the case studies when there was a possibility to gain access to studying news reporting in the mobile context of use. This enabled understanding of the newsmaking practice in addition to usage, experiences and requirements for mobile systems. Quasi-experiments (Jumisko-Pyykkö & Utriainen, 2010; Oulasvirta 2009, 2012) were carried out with mixed methods research designs using questionnaires and interviews as the main sources of empirical data (studies 8 & 12). Quasi-experiments in field conditions were chosen as a research method for these studies for two reasons. First, they enabled the study of user experience with news reporting tasks carried out with smartphones in the natural context of use. Second, they enabled user experience related measurements with predefined reporting assignments created by the researchers, which was not possible in other studies conducted in field settings.

4.2 The research process

The research process is illustrated in Figure 14. The objective of the thesis work was to gain a holistic understanding of user experience in mobile newsmaking with smartphones. Researcher's background in terms of personal interests and goals, prior education and skills, as well as prior work and research experience influence the objectives as well as the whole thesis work and decisions made during the process. The research process of the thesis started at the beginning of the year 2008 with a holistic, exploratory question on user experience: "What is user experience as a phenomenon when using smartphones in mobile newsmaking?". Further initial questions were: "How do users experience the usage of smartphones in newsmaking?" and "What contributes to user experience when using smartphones in mobile newsmaking?". The initial objective was therefore to explore user experience as a phenomenon in the context of journalism when using smartphones as a tool (for creating, editing, sending, and publishing news content and stories) to identify the components of user experience, what contributes to it, and to evaluate the user experience when using mobile systems for newsmaking. In addition, a practical goal was to provide implications for design and development of smartphone-based mobile system solutions and processes to support mobile newsmaking when creating news and news content.

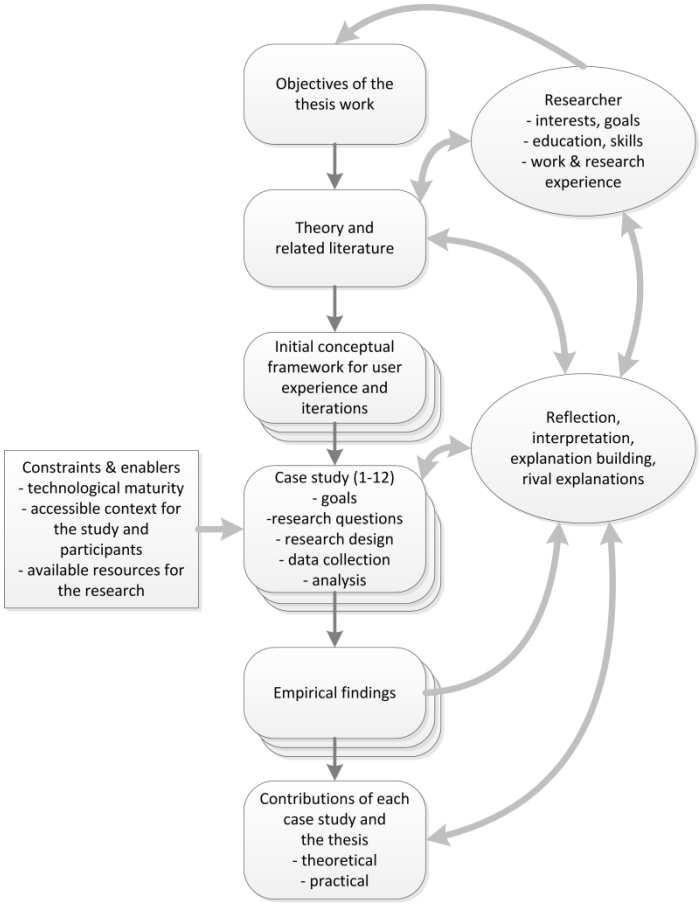

Figure 14. The research process of the thesis work.

Theory related to user experience in the form of models and related literature was reviewed when starting the research. In the first phase of the research, theory and related work were searched for

primarily from the field of HCI. An initial conceptual framework was formed based on the selected existing user experience models (see Chapter 4.2.1). However, the user experience related literature in HCI focuses mainly on consumers as users rather than work-related use. Therefore, in the later phases of the thesis work when the empirical findings needed explanations and interpretations beyond the initial model, theory and related literature was searched for especially from the field of IS, as it has a strong tradition in studies of work-related systems. The initial conceptual framework was elaborated iteratively throughout the thesis work. The specific goals of each case study framed the research designs. The reviewed theory and prior literature as well as the iteratively updated conceptual framework informed and influenced the research designs of the later case studies. Research designs were also influenced by constraints and enablers related to maturity of technology, the access to the contexts and participants relevant for the research as well as by available resources, such as number of investigators and available time for the research (see sections 4.1 and 4.2.3).

The empirical findings were reflected on and interpreted using theory and prior literature as well as by using own prior empirical findings and the deepening understanding of the journalism practice as aids in this process. Exploring theory and related literature were used as support or rivals for the findings. Each case study provided either theoretical or practical contributions, or both. Empirical findings and theoretical contributions were published as scientific publications as journal, conference or workshop articles as well as two master's level theses that were carried out during this thesis work. These publications also contained in most cases practical implications. In addition, practical implications were directly communicated to the stakeholders in the collaborating organizations.

The thesis work is also a learning process for the student. Student gradually gains more experience in planning, carrying out and publishing research as well as starts to master the methods, specific area of research as well as theory and the prior literature. The knowledge is accumulated throughout the thesis work. Learning during the process influences the further decisions made during the process. As the research of this thesis work progressed, the studies aimed at a more in-depth understanding of user experience by extending and confirming the prior findings, understanding the context and activity of mobile newsmaking in more depth to find explanations for the findings, as well as to study specific questions that arose during the studies. In addition, as the practical goal was to support the development of future solutions, specific themes related to the future development of mobile solutions and mobile collaborative processes were included in the studies. This approach funneled the research and publishing from multiple viewpoints to user experience when using smartphones in newsmaking to a more focused theme of cooperative newsmaking with mobile technology when using mobile and location-based assignments.

4.2.1 The role of theory in informing the research process

An initial conceptual framework (Miles & Huberman, 1994, pp. 18–22) for user experience and components related to it was created prior to the first case study. This framework was based on the following definitions and models: Forlizzi and Ford (2000), Hassenzahl (2003), Hassenzahl & Tractinsky (2006), Mahlke & Thüring (2007), Thüring and Mahlke (2007), Roto (2006) and Mäkelä and Fulton Suri (2001). The initial conceptual framework (Figure 15) was used to create pre-understanding of the phenomenon under study (Yin, 2003, pp. 28–33) in order to inform the planning

of the initial research design and research questions of the first case study. The role of theory was to to inform the reseach design, but as the research approach was explorative, the emphasis on refining the initial framework and building theory was on the empirical findings and the themes that arose from the studies. As the research progressed, the initial conceptual framework was therefore refined and extended based on the empirical findings of the research, further related literature, and theory.

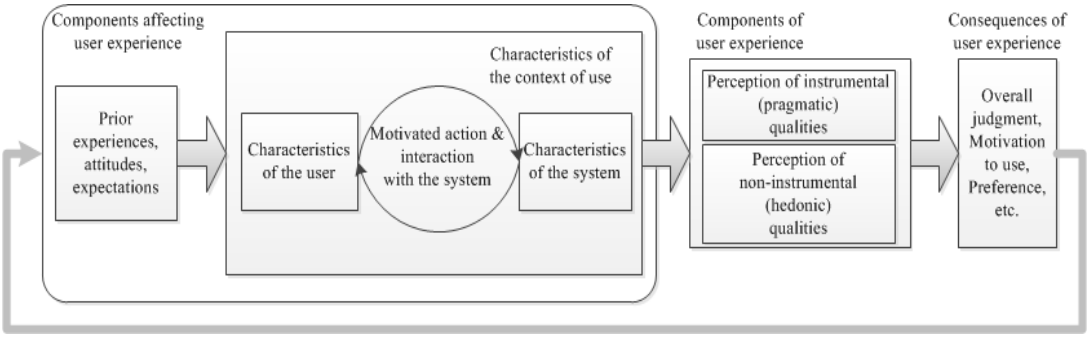

Figure 15. The initial conceptual framework for user experience at the start of the thesis work.

Based on the initial conceptual framework when planning the research design of the first study, the components that were to be addressed related to user experience were the characteristics of the user, system, and context of use, the instrumental and non-instrumental system qualities, as well as consequences of user experience. As the data collection progressed, the gained initial findings, interpretations, and inferences aided in iteratively refining and extending the conceptual framework and the research design of the study at hand, as well as the research designs of the later studies.

4.2.2 Interpretation based on understanding the context of use and practice

As the first study was ongoing, it became clear that it is important to understand the context of newsmaking and the activity beyond the moment of physically interacting with the mobile system (the smartphone and mobile journalism service client) when accomplishing a specific task (see Table 8). To understand and interpret the findings, it is important for a understand the context of journalism and the journalism practice, how the studied technology fits and is interwoven into this context, activity, and practices, and what are the perceived impacts of the studied technology.

Another issue that was discovered during the first study was that the originally chosen definitions and models for user experience and findings from earlier studies on user experience were partly limited in providing explanations. Approaching the context of use more widely than as a set of characteristics related to the moment of interaction was addressed in relatively few prior empirical studies on user experience. On the other hand, this finding was natural due to the exploratory nature of qualitative research, which aims to search for explanations and interpretations, even in the case when theory is used in the planning of the studies (Carroll & Swatman, 2000; Eisenhardt, 1989).

4.2.3 Constraints affecting research designs

The maturity of the studied technology and systems is a constraint that may limit the possibility of using the systems in real-life usage. This is especially the case when the area of the study is in a work domain where users must carry out their work regardless of the technology used. In the context

of journalism, the professionals carry out their work in hectic deadline oriented everyday environments. Research prototypes may be unreliable and have usability issues that take extra time to use, and create challenges in, or completely hinder, the accomplishment of a task. These issues, in contrast to the activity and goal related requirements, create constraints that limit the possibility to carry out studies with prototype systems and to trial new newsmaking processes in a real-life context. Therefore, the closest possible solution in this thesis when studying professional use was to study the phenomenon and the usage of smartphones and prototype solutions in a real-world context – the practice oriented context of journalism education (studies 1, 3, 4, 7, 9, 10).

In journalism education the situated learning (Lave et al. 1991) or experiential learning paradigms are applied in real or in the "simulated" world of journalism practice (Steel et al. 2007). Most of the participants in the studies that were conducted in a university setting had practical work experience or earlier education in the field of journalism. In the quasi-experiment for reader participation, the participants were selected based on their interest in the activity being studied (study 12).

The focus and final research design of some of the studies was also affected by the maturity of the technology. First, in nine of the twelve studies, the original plan was to use smartphones with a mobile service client prototype for mobile newsmaking and study the user experience when using them in mobile newsmaking. In two of the studies (studies 5 and 7), the prototype version that was planned to be used was not functional when carrying out the study. This changed the research design and focus of the studies. Therefore, in study 5, the decision was made to study the work and collaboration of a news journalist and photographer to understand more deeply their work, the context of newsmaking, and collaboration – instead of trialing the mobile service client prototype. In study 7, the data collection was done with a focus group interview instead of the originally planned longitudinal study on user experience. Also, in study 3, the original plan was to use a research prototype for sending mobile assignments to the participants and to send the created material with the prototype system to answer the assignments with created news stories. Due to the prototype not being functional at the time of the study, the final setup had an FTP based mobile client for uploading of content. Therefore, the focus of the study was shifted to using the smartphones for making news videos as well as more generally on mobile newsmaking with smartphones. Furthermore, in one of the studies (study 9) a number of usability issues related to the used prototype were present. This had a strong effect on the empirical findings related to user experience, focusing the findings on usability issues. This study showed concretely that the maturity of the prototypes in user experience studies carried out with real activity and goals needs to be conducted at a level in which basic usability issues do not dominate and affect the findings.

4.3 Empirical studies

The twelve empirical studies that were carried out to explore user experience, its components, and collaborative processes when using smartphones in mobile newsmaking are characterized in Table 8. The smartphones and mobile service client prototypes are described in Appendix 3.

User experience in mobile newsmaking with smartphone based systems was in the focus of ten studies (1–4 & 7–12). In addition, collaboration in newsmaking processes was studied in nine studies

(1, 3–6, & 9–12). Eight studies (1, 3, 4, 7–10, & 12) were carried out as intervention studies, with a smartphone as a newsmaking device in a mobile context. Seven of these studies included the usage of a dedicated mobile service client for newsmaking. Two of these studies (8 & 12) were quasi-experiments in field conditions. A quasi-experiment in field conditions was carried out in study 8 as one group pretest–posttest design for the assessment of system quality, in combination with one group post task only design for satisfaction, by carrying out two newsmaking tasks with the system and observing the outcome (Shadish et al., 2002, pp. 106–11). Study 12 aimed for a quantitative comparison of the user experience of two mobile content creation and submission solutions when used in field conditions. A within-subjects design with pseudo-randomly counterbalanced test conditions was carried out. Study 12 also used a simulated location-based assignment process to provide the participants with hands-on experiences of location-based assignments. This aimed to enable them to assess their participation preferences in the mobile and location-based assignment processes based on experience (rather than their attitudes without any hands-on experience).

4.3.1 The participants

There were, in total, over 100 participants in the twelve studies (see Table 8). The participants of seven studies (studies 1, 3–4, 6, 8–10) were students of journalism or visual journalism and studies were carried out in the context of their university studies. Most of the students had part- or full-time work experience in journalism, either as trainees, freelancers, professional journalists, or photographers (Table 8). In three studies, the participants were journalism professionals working for newspapers. Specifically, in study 2 carried out in 2008, six professionals were interviewed on their smartphone usage experiences. At the time of the study they were the only or one of the few professionals who used smartphones in their organization for newsmaking activities. The participants in study 5 whose mobile work and collaboration were studied were a news journalist and a news photographer working for a local newspaper. In study 7, the participants were professionals who worked in newspapers and participated at the university in supplementary education on using smartphones in newsmaking.

In the first study concentrating on reader participation to newsmaking (study 11), the participants were readers whose photos had been previously published online and printed versions of a hyperlocal news publication and who had been rewarded for their published photos. In the second study on reader participation (study 12, i.e., the quasi-experiment in field conditions), the participants were selected based on their interest in the activity and in mobile solutions being studied for collaborative newsmaking.

Participation in the research was voluntary in all of the studies. Informed consent in written form was asked from each participant for participation, audio recording, and usage of the researchers' photos and videos of them. The participants were compensated with two movie tickets (value 17 euros), gift cards of about the same value, or with other smaller valued items, such as memory sticks.

Table 8. The content of the studies and the literature review (adapted and extended from P6).

Study	*Time*	*Study setup*	*News content (T=text, P=photo, V=video)*	*No. of participants*	*Work exp. in the field of news (part & full time)*	*Data coll. (I=interview Q=questionnaire O=observation FG=Focus group)*	*Nr of investi-gators in the study*	*Publica-tions*
1	2–4/ 2008	Journalism and visual journalism students publish an online news blog in a web publishing course for university staff over 2 days	T, P, V	19	min=1 yr, max=18 yrs	Pre-I (5/19), Pre-Q (19/19), O (85h), Post-Q (15/19) Post-I (15/19) Photos, video clips, facts on created news	6	P1, P2, P3, P4, P5, P6, S1, S4
2	4–6/ 2008	Interviews of early adopters of smartphones who worked in Finnish newspapers	T, P, V	6	min=3.5 yrs, max=10yrs	I (6)	2	P6, S2
3	10–11/ 2008	Visual journalism students create and upload news videos for online news of a local newspaper from the field	P, V	10 (+3 pros at a news org.)	min=0 yrs, max=23 yrs	Pre-Q (10) Pre-I (5), O (28h,) Post-I (9+3) Photos	4	P5, P6
4	3–4/ 2009	Visual journalism students produce news reports based on mobile tasks for an online news publication at a media conference and two pre-trials	T, P, V	8	min=1 yrs, max=25 yrs	O (36h), FG (8), Q (7) Photos, data on created news content, drawings	3	P6, P7
5	7/ 2009	A study on the work of a journalist and a photographer at a local newspaper	T, P	2	min=7 yrs, max=9 yrs	O (20 h), Q (2) Photos, data on created news content	3	P6
6	9/ 2009	A focus group to identify information and communication needs with students of journalism	n/a	3	min=1 yr, max=8 yrs	FG (3), Q (3) Photos, a video	3	P6
7	10–12/ 2009	Professionals in supplementary education produce news stories for an online magazine (VJM)	T,P,V	6	min=5 yrs, max=20yrs	FG (6), Q (6)	2	P6
8	12/ 2009	Journalism students create news stories with photo and video content for two mobile tasks in a quasi-experiment in field conditions	T,P,V	5	min=0 yr, max=1.5 yrs	O (6 h), I (5), 4x mobile-Q (5): pre-assessment, post task x2 + overall assessment Contextual video with a wearable recorder	2	P6
9	3–4/ 2010	Visual journalism students create news stories for an online publication (VJM)	T,P	8	min=1 yr, max=10 yrs	Q (8)	1	P6
10	12/ 2010	Visual journalism students in Finland & print and broadcast students in Great Britain produce news stories for online publications: VJM, Hotpot, and (in Great Britain) for two print versions of Hotpot	T,P	11	min=1 month, max=27 months	O (32 h), I (4), Q (11) Photos, data on created news content	1	P6, P7
11	9/ 2010	An interview of / questionnaire for nine readers who had sent reader's photos to a hyperlocal news publisher	T,P	9	NA	I (6/9), Q(3/9)	2	P8, P9
12	11–12/ 2010	A quasi-experiment in field conditions with a simulated location-based assignment process with photo and video tasks	P,V	19	NA	Pre-Q (19), Post-task Q (19)x4 Post-I (19) Post-Q (19) Photos & videos created in the experiment	2	P8, P9
	2009	A literature review on how to conduct user experience studies in the field					4	S3

4.3.2 Apparatus

In eight studies (Appendix 3) the smartphones and the mobile service client were provided for the participants to use. Four different types of smartphone models and four different mobile service client prototypes (some studies with a different prototype version of the client) were used (Appendix 3). The form factor of the smartphones varied from a candy bar with a numeric keypad or software

QWERTY keyboard to a sliding form with QWERTY keyboard. The displays varied from 2.4" color QVGA to 3.5" color TFT LCD and to 3.2" color AMOLED. All smartphones had a 5 megapixel camera with digital zoom, and in the case of the Nokia models the optics were by Carl Zeiss. The maximum available video quality varied from VGA to WVGA and frame rate varied from 25 to 30 fps. Three of the four smartphone models had a touch screen, either resistive or capacitive.

The mobile service client prototypes for newsmaking were in eight of the studies (Appendix 3) provided in most studies by client developers or by the news publisher in study 3. The functionalities of the mobile service clients varied from simply uploading photo and video files to a newsroom server to writing a story, adding media files to the story, adding metadata or precise location information, and uploading the story to publish online directly or as a draft for later publication. In addition, receiving, accepting, and rejecting mobile assignments were functionalities for some of the clients. In seven of the eight studies that included the use of the mobile service clients, they were at least partly functional.

4.3.3 Setup of the empirical studies and the role of the researcher

In all of the studies, the focus was on newsmaking as an activity taking place in a real-world context. Six studies included observation of the newsmaking activity and the use of technology in a mobile context. Focus on the studies in a real-world context was chosen, since using the smartphones and mobile service clients in field conditions with realistic, collaborative news reporting tasks and situations brings out experience components, impressions, and needs that usability tests in a laboratory (Nielsen et al. 2006) or heuristic evaluations (Kjeldskov et al., 2005) may not capture.

In the studies (1, 3, 4, 7, 9, 10) that were conducted within university education, the students' goal was to create, edit, and deliver news content from the location of the news event with smartphones and a mobile service client dedicated for mobile news assignments and news content delivery. The reporting tasks were assigned within the university course, the setting was either ideated by the students themselves, given by the lecturers or course leaders, or assigned by the news editor of the newspaper publisher. Smartphones were used in the mobile context for capturing, editing, and delivering news content, that is, text, photos and/or video clips, or complete stories. Participants were free to use any other phone functionalities, such as calling, messaging, navigation, the Internet, and social media services if they wished and according to their needs.

The created news material was published primarily in journalism education related online publications, such as VJM magazine and Hotpot (studies 1, 4, 7, 9, 10), online and printed news of the local newspaper Aamulehti (studies 3 & 5, the latter study concentrating on professionals) and in a printed course-related newspaper (Hotpot, in study 10). In addition, the photos of the interviewed readers in study 11 had been published on an online photo gallery at the Omakaupunki.fi site of a hyperlocal news publisher as well as in hyperlocal print tabloids Vartti or Metro.

The researchers assigned tasks to the participants only in two studies, that is, in the quasi-experiments of studies 8 and 12. In the rest of the studies, the researchers did not assign any tasks to participants, or influence how the system was used in any way, as the goal was to capture the participants' experiences and usage of mobile technology in as natural settings as possible. The role

of the researcher in this research was to remain an external observer that searches for explanations and does not try to immerse him/herself into the activity and the context.

4.3.4 Data collection methods

The studies used both qualitative and quantitative data collection methods. Several different types of methods were used, as described in the following (see also Table 8).

Participant observations provided in-depth contextual and situated information on users' experiences and perceptions, newsmaking as an activity and how it was carried out in the field as participants went about their newsmaking (Rock, 2001). Observations concentrated on watching what happens – how, why, where, when, with what or whom – listening to what is said and discussed and asking informal questions related to the activity at hand or topic of the study (Hammersley & Atkinson, 2007, p. 3). Observations therefore provided a way to study participants' actions and accounts in context (ibid.). This provided information of, for example, the context of newsmaking, the goals of this activity and the technology usage within the activity, the components and dimensions of the context of use, issues related to collaboration and communication, as well as participants' views and perceptions and their impressions on the technology. Handwritten field notes were collected during the observations and transcribed (Emerson et al., 1995). In addition, as Figure 16 exemplifies, documentary photos and video footage of usage situations and the context of use were captured for research purposes (to corroborate and augment the observation data) (Ball & Smith, 2008). Further, photos and videos served as memory aids (for researchers) of the situation and context.

Figure 16. Examples of documentary photos from field observations. A) A journalist interviews a porter using a smartphone as an audio recorder on the table, B) The interview continues, a photographer captures a photo with the smartphone, C) The journalist writes up the story at a café table, using his notes, as the photographer chooses the photos and edits the video clips for the story.

Semi-structured individual, paired, and focus group interviews concentrated on selected themes related to the goals of the studies (Kvale & Brinkmann 2009), as well as on themes emerging in the participant observations (Saldaña 2011a, pp. 46–47). Interviews were recorded and transcribed. The focus group interviews were audio and video recorded. Video recording was used to establish which participant was talking. In addition, informal, situation related interviews and conversations were carried out during the participant observations in context (Hammersley & Atkinson 2007, p. 3). Handwritten field notes were written from these accounts and transcribed later. The interviews

therefore used both semi-structured as well as informal, situation related contextual interview approaches to collect data.

Questionnaires, both paper and online versions, were used to collect user experience related and demographic data in a structured manner. Questionnaires had closed-ended and open-ended questions as well as sentence completions (Soley & Smith 2008, pp. 131–145). The collected basic background data in the studies included: age, gender, work experience in the field of journalism (studies 1–10), and prior experience of using smartphones in newsmaking. Other types of background data was collected based on the themes and goals of the study in question. In addition, depending of the study, questionnaires included an assessment of the mobile system quality with instruments such as the Attrak-Work questionnaire (P3) and ASQ – After Scenario Questionnaire (Lewis, 1991; Sauro & Dumas, 2009), affective experiences associated with emotional user reactions were measured with SAM (Self-Assessment Manikin, Bradley & Lang, 1994) and assessment of participants' general privacy concerns with items from the Internet Users' Information Privacy Concern Scale (IUIPC, Malhotra et al., 2004), for example.

Complementary sources of collected data included various other data, such as: the news material created by the participants (news stories, news photos, and video footage); the participants' notes, written when carrying out the news reporting (e.g., reporting plans or other reporting related information, interview notes, the structure for the creation of the news video from the footage); the sent news assignments; emails sent by course teachers to students; or manuals for the usage of the media functionalities of the smartphones. These were used as supporting data in the analysis phase, when needed.

4.3.5 Data collection in the field

Seven of the twelve studies (1, 3–5, 8, 10, 12) included data collection that was carried out in the field. Collecting data in a natural setting offers an opportunity for observing the users and activity in a real-life context. It provides in-depth information for understanding participants' user experience, such as their perceptions and reactions, as well as the development needs for technology, the context of use, and how technology is used within the activity. Data collected in the field therefore complements and expands the data collected with other methods. It offers a possibility to find explanations for, and make interpretations of, the research findings from other sources of data by identifying what contributes to the user experience in a real-life context.

To address the goals of the research and provide useful data for the analysis, data collection in the field needs preparation and planning to take into account a number of issues. These issues include, for example: the used technology and tools used in data collection (Jumisko-Pyykkö & Utriainen, 2010; Oulasvirta, 2009, 2012; S3); the data to be collected (Jumisko-Pyykkö & Utriainen 2010, S3); consideration of how the data collection is carried out in practice in real usage situations (Jumisko-Pyykkö & Utriainen 2010, S3); dealing with multiple researchers collecting the data; as well as acknowledging and dealing with threats to validity (Oulasvirta 2012, S3). As Oulasvirta (2012) points out, there still exist relatively few guidelines for planning and conducting user experience studies in the field including the data collection. Therefore, the studies of this thesis applied knowledge from prior empirical studies as a source for the initial practices in planning the data

collection in the field (S3) as well as researcher's practical knowledge, gained prior to the studies of the thesis. As the research progressed these were used to create the approaches related to data collection employed in the studies of the thesis. These employed practices are presented next.

The tools used in data collection in the field included both manual and digital tools (Table 9).

Table 9. Tools used in the data collection in the field observations.

Generic type	*Tool*	*Usage*	*Justification*
Manual	Notebook	Used for taking handwritten notes	Using a small sized notebook, similar to those used by reporters (black covers, plain pages, usually Moleskin® or similar), does not make the researcher standout in the social context of reporting; it is less intrusive for the participants than official looking writing tablets and paper forms.
	Pencil, pen	Used for handwritten notes	A pencil is the most reliable tool for making notes in any weather condition, including rain and frost; a pen can be used if the weather permits.
Digital	Smartphone	Capturing photos and videos; communicating with the participants and other researchers in the field; audio recording	A lightweight, pocket-sized tool; always brought along; easy to carry along in field conditions; provides sufficient media quality for research purposes; similar to the tools used by the participants, helping blending in; a socially acceptable tool in research situations due to its everyday nature.
	Mobile service clients used for reporting	Receiving mobile assignments sent to reporters	Following up the reporting assignments sent to the reporters
	Pocket-sized camera	Capturing photos and video clips of usage situations and the context of use	A lightweight, pocket-sized tool; a small camera does not stand out; easy to carry along in field conditions; provides sufficient media quality for research purposes; provides better quality of captured photos and videos in demanding lighting conditions than with a smartphone.
	Audio recorder	Audio recording in the field	A handheld, pocket-sized audio recorder for high-quality audio recording of interviews in the field
	Wearable video recorder	Capturing video of usage situations and the context of use	A video recorder worn by a participant hanging on their chest for recording a user point of view of the situation and context
	Nokia Sportstracker*	Tracking the time-stamped reporting route during the day; locating the researcher's photos to the map view	Helps researchers to get time-stamped location data and photos in order to connect them to field notes and findings from the interviews and questionnaires

*Beta version – available at the time of writing the thesis summary from Sportstracker (http://www.sports-tracker.com/)

As the collected data in field notes is easily unstructured, and its amount grows to extents that require considerable effort and time in the analysis phase, the writing of the field notes in the studies of the thesis were carried out with a semi-structured approach in relation to data on the context of use. This approach enabled the creation of a protocol for the data to be captured that was shared by the multiple researchers carrying out the research. Appendix 4 provides examples of the context of use related data that were identified prior to the studies to describe the usage situations and the mobile newsmaking activity and were used to guide the writing of field notes in the studies.

In addition to making notes related to the context of use, researchers made notes of any other interesting observations, occurrences, and issues related to mobile technology usage and/or mobile newsmaking, as well as about their own thoughts, impressions, and ideas. The initial themes identified for observations and writing the field notes prior to the field observations are presented in Table 10.

4.3.6 Analysis of data

Methods for data analysis were chosen based on the goal of the research, questions to be answered, and the type of collected data. Qualitative data, such as transcribed interviews, observation notes, and answers to open-ended questions or sentence completions, were analyzed by content

analysis (Krippendorf, 2004, pp. 18–43; Miles & Huberman, 1994, pp. 50–89). Krippendorff (2004, p. 18) defines content analysis as *"a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use"*. Content analysis was data-driven, aiming to answer the research questions by deriving and developing concepts, themes, patterns, and interpretations out of data. This was done by first coding the data, revising the codes as the analysis emerged, and grouping the coded data with commonality to categories (adapted from: Corbin & Strauss, 2008, p. 159; Krippendorff, 2004, pp. 29–40; Miles & Huberman, 1994, pp. 55–72; Saldaña, 2011b, pp. 3–13). The methods used in the coding of qualitative data included holistic coding (Saldaña, 2011b, pp. 118–120), descriptive coding (ibid., pp. 70–73), process coding (ibid., pp. 77–81), and magnitude coding (ibid., pp. 58–61). Initial conceptual frameworks and constructs, based on prior knowledge from earlier research and theories provided additional guidance in categorizing the findings and making inferences from them. However, the data and its findings were essentially the basis for the coding, enabling new themes, patterns, and interpretations to emerge beyond the initial conceptual frameworks and theories.

Quantitative data originated primarily from closed-ended questions in the questionnaires as well as from the quantification of the findings from qualitative data. Quantitative data was described primarily by descriptive statistics. In some of the studies non-parametric methods (Field, 2005, pp. 521–567; Howell, 2002, pp. 691–722) were used in the analysis due to small sample sizes and non-Gaussian distributions of the data.

As the overall aim of this thesis is to provide a holistic understanding of user experience and its components in mobile newsmaking with smartphones, abductive reasoning (Krippendorff, 2004, pp. 36–38) was used to search for explanations for the research findings, both from theory and from prior empirical research findings. This process of interpretation and explanation building can be described as follows. First, theory and earlier research inform the research design of the study. Second, understanding evolves based on the empirical findings from the study as well as from the created practical understanding of the context of the study. Third, the creation of further interpretations and making inferences based on abductive reasoning – theories and earlier research are revisited to search for support, alternative explanations, and contradictions. These phases, gained insights, research findings, explanations, and interpretations in turn informed the planning of the next study or the analysis and interpretation of the data in the upcoming analysis cycles.

Table 10. Examples of themes for observations and writing field notes.

Theme	*What was paid attention to*
Usage of mobile technology	How is the mobile technology used (for what, when, where, why)
Issues encountered in usage	Issues encountered with usage of the mobile technology
Participants' experiences	Participant's comments, verbal impressions on system quality, verbally expressed feelings and attitudes, stated development ideas and needs
Mobile newsmaking related activities	The phases of the mobile newsmaking and related activities, how newsmaking is carried out in mobile context, the effect of smartphones on newsmaking (e.g., content and story creation, how the activity is carried out), The use of artifacts and created artifacts in newsmaking.
Communication and cooperation	Communication and cooperation of the participants (with whom, why, about what, situation, mobile technology)
Externals' impressions	Externals' reactions and comments on the smartphone usage
Researchers' impressions	Researchers' thoughts, impressions, ideas, raised questions, and initial inferences during observations

5. Results

This section summarizes the answers to the two research questions based on the publications:

1. What is user experience in mobile newsmaking with smartphones? (section 5.1) and
2. How can mobile and location-based assignments support cooperative newsmaking? (section 5.2)

The studies of the thesis focused on newsmaking in newspaper industry and the use of smartphone-based mobile systems for professional newsmaking (P1-P7) as well as on readers using smartphones in cooperative newsmaking (P8, P9).

When answering the first question a model for user experience in mobile newsmaking is presented as a synthesis of the results presented in this chapter and the related work (Figure 18). It updates the initial conceptual framework for user experience that was presented in the previous chapter (Figure 15). In addition, the CoU-MHCI model for context of use (Jumisko-Pyykkö et al. 2010) is used as a framework for describing the characteristics of the context of use that can contribute to the user experience in mobile newsmaking. Findings validate the CoU-MHCI model with empirical research findings and extend the model with three subcomponents. Both of these models can support academics and practitioners in development, research and evaluation activities from identifying requirements to evaluating the solutions. In addition, they can support managers in news organizations in making decisions about the selection and implementation of solutions for mobile newsmaking and what to take into account both in terms of technology as well as in terms of enhancing acceptance and system use.

As an answer to the second research question, a process model for mobile assignments (Figure 17) summarizes the thesis work on cooperative processes related to information and communication related requirements in different phases of mobile and location-based assignment processes. In addition, a framework for the characteristics of the context of use that can contribute to user participation when using mobile and location-based assignments is presented in section 5.2.2 (Table 19). The properties of mobile and location-based assignments (Table 20) that were identified as mobile reporters' information needs are presented to support using mobile assignments in news organizations. These results can aid in implementing assignment-based mobile newsmaking processes in the journalism industry as well as practitioners who develop solutions for the processes.

The results are summarized next in the order or the reseach questions and summarizing the thesis work in the last section by a constructed model of user experience.

5.1 What is user experience in mobile newsmaking?

The research on using smartphones as tools in mobile newsmaking aimed at a holistic understanding of user experience. The research aimed to answer the following main research question: "What is user experience in mobile newsmaking with smartphones?".

First, the user characteristics that can contribute to user experience are presented. Second, the characteristics of the the system that can contribute to user experience in mobile newsmaking are summarized. Third, an extensive set of characteristics of the context of use that can contribute to user experience is described. The perceived impacts as benefits and costs are described, as well as the notion of journalistic quality is discussed in terms of the requirements for the tangible outcome of system use (news material or news). Based on the findings, the model of user experience in mobile newsmaking with smartphones is presented. It includes the components, consequences of user experience as evaluative judgments on system and outcome quality, and overall evaluative judgments. The model is presented in section 5.3 as a summary of the findings on the components of user experience presented in sections 5.1 and 5.2.

Based on the thesis work, the main components that can contribute to user experience in mobile newsmaking are the user, system, the context of use, and the tangible outcome (created, edited, published news material or news). Further components for the user experience model are the user's impressions on the system quality based on user's experience of using and interacting with the system within the activity. They are described by four groups of descriptive qualities (instrumental and noninstrumental qualities, quality of outcome and perceived impacts). In addition, the readers and other stakeholders, such as colleagues, editors, the customer of a freelance journalist, reader reporter or their peers, assess the news items and news created with the mobile system. Although this was not in the focus of this thesis work, their expected impressions and satisfaction with the quality of the outcome seem to contribute to the user experience of the mobile reporters. Next, the results are discussed in more detail.

5.1.1 The user

The user refers to the person that interacts (controls and manipulates) the mobile system in the activity of mobile newsmaking in mobile context of use. Identified user characteristics that can contribute to user experience are 1) professionalism, 2) the motivation for use, 3) professional identity, 4) prior experiences, 5) expertise in photography, and 6) personality. Table 13 presents a categorized summary of the findings, and the publications in which they appear.

Professionalism refers to people who work or study in the field of journalism or photo- or visual journalism, as opposed to readers or crowdworkers with no professional experience in the field of journalism. Looking first into the user experience of professional users, there was a difference in the user experience when using smartphones in news reporting dependent on whether the background of the mobile reporter was as a journalist or a photo- or visual journalist. Some participants with a journalistic background as writing journalists explained that the quality of writing is more dependent on own thinking than on the available tools. One of the journalists expressed that content is more important for professional quality than technology: "*For me the professional quality is more about the content than the technology; quality comes from a well-written story and good photos*" (Male, 25). He takes up the entity of the story and narrative as a quality factor and the skill of the reporter as an important factor for producing news with high quality. The technology is an enabler and a means to an end when reporting. Picard (2000) suggests that the quality of journalism is dependent on information gathering and processing activities, as well as on knowledge and mental processes.

Technology can be used as a tool in information gathering and processing, but the knowledge and mental processes are largely independent of technology. On the contrary, for photojournalists and visual journalists, a camera was expressed as being a necessary tool for expression and for story telling, which needs to be mastered to the level of being automatic and instant. Jayaswal (2008) describes that photojournalists use their news and visual sense to communicate through photographs and tell a news. The results indicate, that the role of technology in newsmaking can be different for these two groups of professionals and the experience therefore can depend on professionalism and the needs related to the profession.

When comparing the assessment of the perceived pragmatic and hedonic qualities of the mobile journalism system, the students of visual journalism assessed hedonic quality stimulation more negatively than the students of journalism (P3, P4). A similar trend was found for hedonic quality identification (P3, P4). Specifically, students of visual journalism assessed the system as limiting creativity and constricting professional ambition more often and more strongly than the students of journalism (P4). In addition, visual journalism students assessed the system to be unconvincing in the eyes of externals and undervalued by professionals, whereas journalism students assessed the system to be credible (P4). Furthermore, the students of journalism assessed the system to be more appealing in terms of the interestingness than the students of visual journalism (P4).

Table 11. User characteristics that can contribute to user experience.

Characteristic	Findings	Publication(s)
Professionalism	Professional background can contribute to user experience (people who work or study in the field of journalism or photo- or visual journalism, as opposed to readers or crowdworkers with no professional experience in the field of journalism).	P1-P9, S1, S2, S4
Motivation for use	User experience can be positively influenced by the motivation for use that can be moderated by • the perceived or expected benefits for the mobile reporter (see Table 18) • the perceived or expected benefits for newsmaking (see Table 18) • the perceived or expected benefits for the news quality (see section 5.1.5).	P1, P5, P6, P7, P8, S1, S2, S4
	User experience can be negatively influenced by the motivation not to use, whic can be moderated by • the perceived or expected costs for the mobile reporter, newsmaking and news quality (see Table 18).	P1, P3, P4, P5, P6, P7, P8, P9, S1, S2
	Tool use is externally regulated and mandatory by an order from the employer (voluntariness of use).	S2
	The tool can signal the personality of the user as a technological forerunner (self-expressive symbolism).	P1, S2
	Interest and eagerness to try out new technology can contribute positively to user experience.	S2
Professional identity	The reporter's professional Identity and the ambition to deliver good journalistic work can set expectation for the quality of the outcome (news or news items).	P1, P3, P4, P6, S1, S2
	The reporter's identity as a creative professional can be supported or limited by the used technology.	P1, P3, P4, P6
	The tool is a symbol of the profession that expresses group membership and status (categorical symbolism).	P1, P3, P4
Prior experiences	Prior negative experiences when using mobile phones in journalistic tasks can contribute to expectations for the future use and experience of mobile phones for similar tasks.	S4
Expertise (skills) in photography	A professional or hobbyist background in photography can contribute to user experience by setting expectations for the quality and the system features and functionalities.	P1, P3, P4, P6, P8, S1, S2
Personality	Signaling one's personality as a technological forerunner by use of novel technology (self-expressive symbolism).	P1, S2

The participants with prior professional or hobbyist experience in photography with a system's camera (expertise) were more critical towards the use of smartphones for photography whether a professional or reader reporter was in question (P1, P3, P4, P6, P8, S1, S2, S4). This was expressed to be due to the lower technical quality of the captured photos as well as the constriction of creativity

and the possibility to capture the message that one wants to communicate with the photo. Most of the students of journalism as well as readers participating in the studies were satisfied with the quality of photos captured with smartphones as well as the ease of use of the device (P1, P6, P8). No clear differences were found in the satisfaction with the video quality or the ease of use dependent on professionalism (P1, S1, S2, S4). However, professional expertise in photography revealed expectations, needs and requirements related to the system features and functionalities in the video capture and editing (P5). As a limitation for the findings on video quality, none of the participants had extensive experience in shooting video footage with other equipment.

The results indicate that the motivation for use can contribute to user experience. The perceived or expected benefit, for a mobile reporter, for newsmaking and newsroom staff, or for news quality, seemed to be related positively to the motivation to use smartphones in mobile newmaking (P1, P5, P6, S1, S2, S4). Benefit is defined as "*something that promotes well-being, or a useful aid, and is made possible by the studied solution*" (adapted from: Merriam-Webster, retrieved 30.7.2013; Rothenburg 1969).

On the contrary, the perceived or expected costs of using smartphones in mobile newsmaking seemed to lead to dissatisfaction with the quality of the outcome of usage and not being able to be proud of the outcome, lowered enjoyment of an activity that is intrinsically motivating, and caused frustration due to not being able to achieve what one wants. These lowered the motivation to use and seemed to contribute to user experience negatively. However, participants weighed the benefits against the costs. The benefits for newsmaking and newsworthiness were prioritized over personally experienced costs, at least in short term use. Newsworthiness (in terms of urgency, authenticity and timeliness of news), or having no other equipment available for capturing newsworthy events, especially justified use in the case of a professional user (P1, P6, S4). Cost is defined here as the "*loss or penalty incurred especially in gaining something in comparison with what was possible with the prior or alternative resource–use configuration but no longer possible with the studied solution*" (adaptedfrom: Merriam-Webster, retrieved 30.7.2013; Rothenburg 1969).

The studies revealed professional identity and the ambition to deliver good journalistic work to be important for professional reporters (P1, P3, P4, P6, S1, S2). Professional identity is defined as the "*relatively stable and enduring constellation of attributes, beliefs, values, motives, and experience in terms of which people define themselves in a professional role*" (Schein 1978, as cited by Ibarra, 1999). Professional identity sets expectations for the quality of the outcome, i.e., the captured, edited, transmitted, published news content (text, audio, video, photos), and entire news stories. The creative and to varying degree autonomous nature of the work is part of professional identity both for news journalists and photo- and visual journalists. Therefore, either the support of creative work or limitation of it due to the used technology, were found to contribute to user experience (P1, P3, P4). Furthermore, prior negative experiences negatively contributed to the expectations of students of visual journalism when using smartphones in mobile newsmaking compared to students of journalism with no similar prior experiences (S4).

The symbolic meaning of the tool used for newsmaking was raised in the findings (P1, P3, P4, S2). Self-expressive symbolism (Crilly et al. 2004; Dittmar et al. 1995) – signaling personality as a

technological forerunner when using a novel tool – was mentioned positively by the students of journalism (P1) and journalists (S2). Categorical symbolism (ibid.), which refers to signaling the group membership of photographers with a tool, was described negatively by students of visual journalism (P1). On the contrary, the smartphone-based system as a tool was considered to signal status by some students of journalism (P1). The students of visual journalism missed having a system's camera as a symbol of their profession when they used smartphones in reporting (P1, S4) and assessed smartphone usage in newsmaking as lowering the credibility of a reporter (P4).

In summary, user experience may be contributed to by professionalism, the motivation for use that is mediated by the perceived benefits or costs (for a mobile reporter, newsmaking or news quality), professional identity, prior experiences of using similar mobile technology for newsmaking, and expertise in shooting photos with other tools.

5.1.2 The system

The system that contributes to user experience consists of a mobile system, a wireless network, as well as editorial systems and related editorial processes. In the studies of this thesis the mobile systems have a smartphone as the main component. In addition to its own features and functionalities, a smartphone is a mobile platform for mobile applications and mobile service clients that can be installed on a mobile device. It also provides a gateway to information and social networks through its capabilities.

When a smartphone is the main component of a mobile multipart system, the mobile system may include external parts, such as a microphone, a keyboard, or a display, that can be connected to the smartphone physically with a cable or wirelessly, such as with a Bluetooth connection. The network enables the wireless or cellular transmission of data to and from the mobile system. The editorial processes and systems facilitate the mobile newsmaking in organizational settings where news is produced cooperatively. In addition, the mobile system, a mobile application, or a mobile service client can be a component of a cooperative platform that facilitates both editorial processes and mobile activities in news production, such as in the case of mobile assignments and mobile crowdsourcing, for example.

The small size, lightweight, ease-of-use, and the fact that nowadays people always have their mobile phones with them, were perceived as the ultimate strengths of smartphones (P1, P5, P6, S1, S2). In addition, the multiple functionalities enable mobile newsmaking with only one multipurpose device (P6, S2). The perceived and expected benefits that were related to positive user experience and motivated use are summarized in Table 18. The suitability was dependent on the situation and available tools for reporting as described by a photographer: *"This system would be suitable for being in your pocket, and if there were a situation where you need to capture a video, the device would be good, because it is small, always with you and its features are sufficient for news."* (Male, 25). However, there were a number of weaknesses related to the system features and functionalities that contributed to interaction and carrying out the work and activity of the mobile reporter, as well as had impacts on the journalistic quality, which were perceived as costs (see Table 18).

Table 12 summarizes the system features and their characteristics that can contribute to user experience. In addition, it also presents the subactivity in mobile newsmaking that the feature and its

characteristic contribute to as well as the effect of the characteristic. Presentation aims to support development activities by connecting the system feature and its characteristic to its effect. The next subsections discuss the findings from the point of view of the subactivities of mobile newsmaking from the point of a mobile reporter. Specific focus of the next subsections is on news material - writing and editing text, capturing and editing photo and video footage, as well as submission of news content - as these were the main focus of the studies related to news content. The cooperative process related findings on mobile and location-based assignments are presented in more detail under the second research question in section 5.2.

Table 12. System features that can contribute to user experience.

System feature	*Characteristic of the feature*	*Sub-activity that system feature contributes to*	*Effect on*	*Publica-tion(s)*
Display	Small size	Writing and editing a story: Writing text; Visualizing text and getting an overview of the story while writing and editing; Finalizing the text, e.g. proofreading.	Number of spelling mistakes; The feasible length of text; Perceiving the outline and structure of the story; Comfort of working.	P1, P6, S1
		Editing photos and video footage	Checking the quality by zooming into the picture; Editing of videos.	P1, P5, P6
	Flexibly moving display	Capturing video footage	Seeing what is being recorded when working in awkward positions; ergonomics.	P5
Data entry method	The type and size of keypad/keyboard (Keypad (T9), on-device alphabetic keyboard, external QWERTY keyboard)	Writing and editing text	Feasible length of text; Number of spelling mistakes; Comfort of writing.	P1, S1, S2
		Editing video footage	Accuracy of cutting video clips; Ease of editing.	P5
Form factor	Small size	Photo and video capture; Carrying	Stability in capture; Firmness of grip; Convenience to carry along.	P5, P6, S2
	Lightweight	Photo and video capture; Carrying	Stability in capture; Firmness of grip; Convenience to carry along.	P5, P6, S2
	Physical form	Photo and video capture	Firmness of grip; Ergonomics.	P5
Network (wireless)	Throughput, bit rate, bandwidth, transmission channel	Tasks involving wireless data transmission: especially video delivery in uplink	Speed of data transmission; Interruption of data transmission; Impairments caused by the channel.	P1, P5, P6
	Network coverage and availability	Tasks involving wireless data transmission: any data transmission in field conditions	Speed of data transmission; Interruption or prevention of data transmission.	P1, P5, P6
	Interoperability of multipart mobile system	Connection setup with smartphone external parts	Success and ease of use when setting up the Bluetooth connection.	S4
Battery	Short life	Video editing	Time it takes the battery to run out; Need to find a place and time to recharge; Carrying extra batteries and the charger along; Consideration of what features and functionalities to use when in the field.	P5, P6, S2
		Video submission	As in the previous point	P5, S2
		GPS usage for locating, e.g. navigation	As in the previous point	P6
		Data transmission: e.g. Internet, email, mobile services	As in the previous point	P5
Processing and memory capacity	Parallel operations enabled	Simultaneous parallel usage and switching between several services or applications; Multi-tasking; Computationally heavy operations, such as video recording with preview and editing of video clips.	Usage of other features than the most capacity consuming; Speed of functionalities; Crashes and loss of work in video editing.	P5,P6, S4
Multimedia	Sensors and signal processing in audio, video and photo capture	Capturing of audio, video, and photos	Number of captured photos; Technical quality of media items; Constrained freedom of expression; The effect of audio recording quality on how and what type of video footage can be captured.	P1, P6, S1, S2

Multimedia (cont.)	Optics	Capturing of photos and video footage	Technical quality of captured content.	P1
	Adjustments for photo and video capture	Capturing of photos and video footage	Number of captured photos; Technical quality of the media items lowered; A feeling of control over the capturing; Freedom of expression.	P1, P6, S1, S2
	Delay in media capture and focusing, shutter speed	Capturing of photos and video footage	Capturing the "passing moment; Out-of-focus footage; sharpness; Capturing a moving object and fast action.	P5, S1
	Digital zoom and point of focus	Capturing of photos and video footage	Lowered resolution; Freedom of expression constrained; Feeling of control over the capturing lost.	P5, S1, S2
	Editing functionalities	Editing photos and video footage	Types of multimedia stories enabled; Technical and content-based quality.	P5, P6
Dedicated mobile applications and services	Available functionalities	Capturing, editing and submitting text, video, audio and photo footage and their combinations.	The quality of the outcome, i.e., news content or news story; Needed workarounds for completing the news reporting; Satisfaction with ease-of-use and the used time on the task.	P1, P5, P6, P8, S2
Editorial systems and processes	System interoperability, workflow support	Submission of news from the field; Feedback for submission of material;Finalizing the material for publication.	Arranging for someone in the newsroom to handle the material; Calling the newsroom to get confirmation of the reception of material; Control over layout; Number of spelling mistakes.	S1, S2
Communication	Synchronic and asynchronic	Communication within newsmaking with newsroom, informants etc.	Support for, suitability and convenience in newsmaking; Fit to the situation.	P6, P7
Multifunctionality	Features and functionalities to serve all phases of news making	All phases from idea creation or an unfolding event to gathering material, production and publishing can be done with one tool	Support for, suitability for and convenience in newsmaking; Fit to the situation.	P1, P5, P6, P7, P8, P9, S1, S2
System feature	*Characteristic of the feature*	*Sub-activity that system feature contributes to*	*Effect on*	*Publication(s)*

5.1.2.1 Writing and editing text

The experience of writing and editing text for a news story was affected by the display size and data entry method, specifically the keypad or keyboard used (Table 12). The size of the display was characterized as being small in smartphones that made the detection of spelling mistakes difficult. Due to this, the number of spelling mistakes was experienced to increase compared to traditional tools for writing, such as a laptop. This lowered the error-freeness of the text and participants felt that proofreading in the newsroom may be needed prior to publishing the news to maintain the journalistic quality required in professional news publishing. Perceiving the outline and structure of the text was described as being challenging, shortening the feasible length of text for a news story written on a smartphone compared to traditional tools. Limitations on visualizing the text and gaining an overview also potentially affected the perceived content-based quality of a news story. In addition, the available functionalities for text editing were expressed to affect the finalization of the article and the quality perceived by the audience. Support for spell checking was mentioned as a need to decrease the number of spelling mistakes. It seems that in case of professionals, direct publishing from the field with smartphones can be experienced to affect the quality of published news negatively. Supporting workflows in the newsroom may be required to ensure journalistic quality.

In addition to the display size, the keypad or keyboard used for writing affected the feasible length of the text to be written. A non-alphabetic keypad (T9) was convenient for short texts of a few hundred characters, whereas an on-device alphabetic keyboard or external QWERTY keyboard were

more convenient for somewhat longer texts, upto around a thousand characters. Both the display size and the text entry method were experienced to affect the feasible length of the text as well as the comfort of writing. One of the students of journalism in the first study described the suitability of a smartphone-based system use for a journalist's work: "*If this were the only tool for work, it would result in corpses – the Mobile Journalist Toolkit cannot as such replace the traditional PC in a journalist's work, but it is not intended to do so either. It is an extreme example […]; it is a makeshift. In principle one could write a novel with the Mobile Journalist Toolkit, but very few people have the required patience without years of monk training in Nepal."* (Female, 22) This quote illustrates how a smartphone-based system is experienced by the participant to be suitable as one of the tools among the other tools a writing journalist uses and as a makeshift, but not as the only tool for a professional journalist.

The mobile reporter's experience of writing and editing text can be influenced by the size of the display, the text entry method, and the size and type of the available keyboard. In addition, support by the mobile application or service client to visualize the outline and structure of the story, spell check, and perform the special needs of editing – such as character count, inserting special characters, and headline fonts – was called for. The effect on user experience concerns the comfort of writing and the quality of the outcome (i.e., the text or story).

5.1.2.2 Capturing and editing photo and video footage

The experience of shooting photo and video footage was influenced by the smartphone's multimedia related features and functionalities (Table 12) as well as by professionalism and expertise in photography, as described in the user characteristics earlier (Table 11). The technical quality, especially of captured photos, was experienced by those with expertise in photography to be lower than captured with traditional gear due to sensors and signal processing, camera optics (lens), missing (manual) adjustments, experienced delay in photo capture and focusing, shutter speed, digital zoom as well as due to not being able to control the point of focus. The form factor of smartphones sets limitations on the sensors and lenses that can be accommodated by the device. The limitations were experienced especially by those with expertise in photography to influence the photojournalistic quality that can be described in terms of expressiveness, aesthetics, interptretativeness and vision relating to story telling. Limitations in capturing and the perceived quality decreased the number of captured photos and experienced ability to "capture the moment". The freedom of expression and control over capturing and device and therefore the photo and its quality was felt to be lost when using a smartphone. On the contrary, those with no professional or hobbyist background in photography were satisfied with the ease of use, simplicity in image capture and time needed for capture with no manual adjustings needed. In addition, the appropriateness was affected by the situation at hand, the available tools, the intended publishing channel, as well as by the customer's requirements.

When shooting video footage, the ease of use and simplicity were valued by participants. Most participants found the quality of the video clips sufficient for online news, especially in the case of reporting breaking news. The authenticity combined with the roughness of the video footage was

perceived as acceptable and even desirable in timely news reporting. The smartphone enabled the approach of visual reporting from new angles not possible with traditional gear. The form factor and relatively low price enabled envisioning and trying out new ways to capture footage, such as tying or taping the device onto moving objects: a book travelling through the book drop at a library, the window of a revolving restaurant, an arm, a bike, a car, or similar.

However, some participants, who captured video footage, expressed similar concerns how the limitations affected the quality of captured footage. Especially in the case of shooting videos, but also when shooting phots, the form factor of the device was emphasized as being important for getting a firm grip of the device and for stability in shooting. These were deficiencies when using a smartphone. In addition, the limitations of the audio capture due to the microphone picking up ambient noise as well as being insensitive to the interviewee's speech, affected the capturing by limiting the freedom of the recording angles as well as the quality of the captured video footage. A photographer described the suitability for video capture: "*This system would be suitable to be kept in the pocket, and if there were a situation where you needed to capture a video, the device would be good, because it is small, always with you, and its properties are sufficient for news."* He/she emphasizes the general perceived benefits of smartphones and the situation as the factors affecting the suitability for using a smartphone for video capture.

When professional news reporters edited photos and video footage, they used mainly simple functionalities of the available mobile editing software. When choosing photos, the small display size made selection cumbersome and slow and made it difficult to assess whether or not the photo was in focus. Users needed to zoom into the pictures to be able to assess the technical quality of the photo. Typical editing functions carried out by journalists, such as cropping, using only a section of the picture, or enlargening it beyond its original size, bring out the challenges in regard to the resolution and pixelization of the photo. Used functionalities in editing video clips included cutting the video clip at the beginning and end, and adding a title at the beginning and credits at the end of the clip. At times, separate editing of the audio track was carried out, as well as merging several video clips together. Doing this with a small display and a keypad or an on-device keyboard was cumbersome and imprecise when cutting the audio and video clips. This was expressed to contribute negatively to the quality of the edited video footage, the comfort of working, as well as the speed of editing.

The experience of shooting photos and video footage is dependent on the perceived quality of the captured photos and video footage, and the quality in use. Sensors and signal processing, camera optics, adjustments for capture, the speed of starting up capture, focusing, shutter speed, digital zoom, and controlling the point of focus all can contribute to the user experience. In addition, the sensitivity of microphones can contribute to the quality of the captured audio in video footage. Experienced quality of the system in shooting and editing photos seems to depend on professionalism and expertise in photography. In case of video shooting, ease of use and simplicity in use were appreciated by all user groups. Display size and the used keyboard contribute to the comfort and speed of editing, as well as to the quality of the edited material.

5.1.2.3 Submission of news content

Submission of news content was done in the studies via wireless networks, either cellular or WiFi. The submission of text and photos was nonproblematic. However, there were critical issues in video submission that slowed down or interrupted the submission of the material considerably to an unacceptable level. They caused delay or prohibited the timely reporting and publication, or degraded the quality of the transmitted video clips to unacceptable level for professional news reporting. The critical issues in delivery were the quality of transmitted material and the reliability of the delivery as well as the availability of the network connectivity and speed of transmission. Throughput of the mobile system in video delivery, as well as the bit rate and bandwidth of the transmission channel contributed to experience. As wireless transmission channels are susceptible to interference, the technical quality of the transmitted video degraded to unacceptable levels in some cases.

The capacity of the wireless networks is limited, which caused the submission in some cases to be too slow to support the urgency and timeliness of reporting – the submission was interrupted, or in the case of newsworthy events, the network was too crowded and prevented delivery from the event. In the cases of interrupted or prevented submission the reporter either attempted resubmission of the video footage, moved further away from the event in order to find suitable network capacity for uploading, or delivered the material by hand to the newsroom. Problems in submission may also prevent further reporting, as the reporter needs to concentrate on finding a solution to the problem at hand. This may prevent the usage of the multipurpose system for other purposes in the current reporting related activities, such as finding information on the Internet or recording an interview.

In most of the studies of the thesis, the submitted material was finalized for publishing in the newsroom. Certain quality related challenges created by smartphones can be somewhat compensated for by editorial processes. These include checking the error-freeness of the material and correcting spelling mistakes, making final choices from the news content and footage in the newsroom, and finalizing the layout for publishing. Editorial systems and processes as well as the designed workflows in the newsroom could therefore be designed to support the journalistic quality requirements, when full reliance on mobile tools is not preferred.

Critical issues in the submission of news content via a wireless network were the reliability and speed of submission as well as the effect on the quality in terms of causing imperfections on the submitted content. The availability of the network is a critical factor for submission and for the feasibility of the mobile system for a mobile reporter.

5.1.3 The context of use

The context of use refers to the circumstances under which the activity of mobile newsmaking takes place (adapted from Roto, 2006). The findings on the characteristics of the context of use that contribute to user experience are categorized to five context components (temporal, task, physical, social, and technology and information), their sub-components, as well as properties adapted from the CoU-MHCI model presented by Jumisko-Pyykkö & Vainio (2010). The findings are summarized in Table 13 - Table 17.

Three sub-components were added to the model by Jumisko-Pyykkö et al. (2010) based on the findings. Task context was extended with assignment characteristics, physical context with characteristics of the area, location, or country, and social context by adding stakeholders who are not physically present when interacting with the device but who assess the quality of the news material and reporting. This subsection presents an overview of the findings presented in the publications.

5.1.3.1 Temporal context

Temporal context refers to the interaction and carrying out the activity with the mobile system in relation to time (adapted from Jumisko-Pyykkö et al. 2010). It was characterized by 1) the time spent on the activity, subactivity or task, 2) the deadlines and schedules of the news reporting as well as the availability for reporting, 3) actions prior, simultaneously, or after the interaction with the mobile system, 4) the speed of the activity in terms of hurried and waiting as well as unexpectedness of an event, and 5) synchronicity or asynchronicity of communication (Table 13). Temporal captures the nature of the activity in terms of time. It is related to the news qualities in terms of immediacy, unexpectedness, and timeliness which are important factors of newsworthiness.

Table 13. Summarized findings from publications on the temporal context.

Component	Definition (adapted from Jumisko-Pyykkö et al, 2010)	Findings related to the subcomponents (adapted from Jumisko-Pyykkö et al. 2010)	Publication(s)
Temporal	Interaction and activity carried out with the mobile system in relation to time.	Duration – the length of interaction or the event in which interaction takes place	
		Time (delay, response time) to start up photo and video recording	P5, P6, S1
		Time spent on the activity, task or carrying out a sub-activity, such as recording, editing,submitting	P1, P2, P5, P6, P7, P8, P9, S1, S2
		Time of day, week, and year	
		Deadline, schedule, or continuous deadline	P1, P2, P6, P7
		When the mobile reporter is available for locating and receiving mobile assignments (see Table 19)	P7, P9
		Before, during and after	
		Preparations for capturing, editing, and submitting	P5, P6, S1, S4
		Following up on submission, calling up the newsroom after submission to check on the success of mobile delivery	P7, S2
		The action's relation to time	
		Hurried, waiting, speed	P1, P2, P5, P6, P7, S1, S2
		The unexpectedness of events that call for action	P1, P2
		Synchronism (synchronous–asynchronous)	
		Communication by phone calls, SMS, MMS, email, chat, mobile assignments	P7

5.1.3.2 Task context

Task context refers to the user's tasks and activities surrounding the interaction with a mobile system or when carrying out the activity with the system (adapted from Jumisko-Pyykkö et al. 2010, see Table 14). Parallel tasks and activities included instances of interviewing while audio or video recording, for example. Mobile reporters were also keeping track of characters while writing, as well as time and deadline when carrying out primary tasks or sub-activities. When capturing photos and video footage, mobile reporters needed to be aware of the surrounding physical

circumstances to be able to ensure sufficient technical quality of the footage. Parallel tasks were also found to contribute to the willingness to receive mobile assignments. As the mobile reporters typically work in public spaces, there may be interruptions due to passers-by, or bystanders may take contact and talk to the mobile reporter and interrupt the task being carried out.

Table 14. Summarized findings from publications on the task context.

Component	Definition (adapted from Jumisko-Pyykkö et al, 2010)	Findings related to sub-components (adapted from Jumisko-Pyykkö et al. 2010)	Publication(s)
Task	User's tasks and activities surrounding the interaction with a mobile system or when carrying out the activity with the system.	Multi-tasking – multiple parallel tasks alongside human mobile computer interaction that compete for cognitive resources	
		Primary task interviewing, secondary task recording audio, photo, and video footage, or writing notes with the smartphone	P5, S1, S2
		Keeping track of the number of characters in the story while writing	S1, S2
		Keeping track of time and the deadline	S1
		Awareness of the surrounding physical conditions or constraints of the used smartphone that need to be taken into account when taking photos and recording video footage	P2, P5, P6, S1, S2
		Parallel tasks while receiving mobile assignments (no parallel task, during free time, when working or studying)	P7, P9
		Interruptions – events that break the user's attention from the current task to focus on the interruption temporarily	
		Passers-by	P2
		Interruptions by bystanders who make contact while the reporter is editing at a public location	P2, S4
		The primary task is interrupted by a mobile assignment	P9
		Task domain – macro level of task context by dividing the situation of an interaction into two groups – goal-oriented (work) and action-oriented (entertainment) tasks	
		Primarily goal-oriented for professionals, but may include action-oriented characteristics	P1, P2, P5, P6, P7
		Primarily action-oriented for readers, but may include goal-oriented characteristics in the activity	P8
	Added subcomponent:	Assignment characteristics	
		The type of assignment or reporting to be carried out or the content asked for and attributes of content (no. of characters in text, length of audio and video footage, count of photos, requested quality, special requests like camera angles)	P7, P9
		Monetary incentive, incentive mechanism	P6, P8, P9
		Voluntariness of carrying out the task	P8
		Autonomy in reporting	P7
		No. of receivers	P7
		The creativity needed or allowed	P7
		The needed skills and equipment	P7

On macro-level the task context is divided by Jumisko-Pyykkö et al. (2010) to goal-oriented tasks in work related use and action-oriented tasks for entertainment. In mobile newsmaking, for professionals the tasks are primarily set by the organization or customer, but secondarily, the tasks may include action-oriented elements that could be related to concepts such as flow in addition to enjoyment of the activity as such. For reader reporters the enjoyment of the activity may be the primary motivation to participate (Fröhlich et al. 2012, Väätäjä, 2012) but it may also include elements related to goal-oriented activity and motivations that professionals have (ibid.). The goal-oriented task setting may also apply to crowdsourcing, if the participation is primarily motivated by monetary benefit for the crowdworker.

Furthermore, the assignment characteristics were added as a sub-component as it frames the properties of the task context. Assignment characteristics can be described in terms of the type of assignment, reporting, content or its attributes that are requested for, perceived voluntariness of

undertaking and carrying out the assignment, perceived and expressed extent of autonomy and creativity and needed skills or equipment as well as the incentives. Information related to assignments are presented in Chapter 5.2.3. Assignment characteristics can contribute to the user experience by moderating the willingness to undertake the task and be motivated by the goal.

5.1.3.3 Physical context

Physical context refers to apparent features or physically sensed circumstances while interacting with the system or carrying out the activity with it (adapted from Jumisko-Pyykkö et al. 2010). The work of mobile reporters is characterized by multiple workplaces in dynamic locations. The work is often carried out in public spaces, either outside or inside. Workplaces can be stationary, such as cafés, or waiting rooms, or they may be mobile, such as trains, cars, or airplanes. The proximity of the reporting spot to the reporter's current location as well as the precision of locating mobile reporters can contribute to participation preferences in case of assignment-based processes. The sensed environmental attributes such as lighting, temperature, and ambient noise can contribute to carrying out the activity and influence the capturing of photos and video footage.

Table 15. Summarized findings from publications on the physical context.

Component	Definition (adapted from Jumisko-Pyykkö et al, 2010)	Findings related to sub-components (adapted from Jumisko-Pyykkö et al. 2010)	Publication(s)
Physical	Apparent features or physically sensed circumstances when interacting or carrying out the activity with the system	Spatial location, functional place and space – the aspects of location and material characteristics of location, functional space and in distance participation	
		Geographical location (vicinity or distance)	P2, P7, P9, S1, S2
		Third workplaces (Vartiainen, 2006) – cafés, hallways, canteens, waiting halls etc.	P1, P2, S1, S2,
		The precision of locating mobile reporters	P7, P9
		Sensed environmental attributes	
		Light, lighting	P2, P5, S1, S2
		Temperature	P2
		Ambient noise, sounds	P2, S1, S2
		Movements and mobility – the position and motion of the user's body, the mobility of the user and the motion of the user's physical and functional environment	
		Sitting while editing, reaching out to record footage	P2, P5
		Placement of artefacts in relation to the user's body (e.g. on the knee, on a table, on a sofa)	P2, S1
		Working while commuting	P6
		Artefacts – physical objects that surround a human-mobile computer interaction	
		Proximity of artefacts (e.g. a notebook)	S1
		Chairs, sofas, tables	P2, S1
	Added subcomponent:	The characteristics of the area, location or country	
		Attributes related to the area, location or country such as shady, totalitarian, unacceptable place, safe, dangerous	P7, P9

Physical context is also characterized by movement of the user's body while interacting with the system. User may be sitting or standing while writing, capturing photos or video footage, or kneeling or reaching out while using the system for capturing photo or video footage. The tools may be placed on the user's body such as on the lap or attached to arm, or placed on surrounding objects, such as on a table or sofa. Furthermore, smartphones were in some instances attached to other surrounding objects, such as a book, a bike or a window for photo or video capture enabling new ways of content capture and reporting. The characteristics of the area, location, or country were found to be relevant

in relation to privacy and safety issues when locating reporters and location-based assignments were studied.

5.1.3.4 Social context

Social context refers to other persons present physically or virtually while interacting with the system or using it for the activity, or to other stakeholders of the activity or its outcome (adapted from Jumisko-Pyykkö et al. 2010). Persons physically present while interacting can include interviewees, bystanders, and own colleagues or peers of the mobile reporter. Newsroom staff or a colleague working elsewhere in the field can be virtually present using synchronous (e.g. video or online calls) or asynchronous means of communication (instant messaging or social media services). Other stakeholders may also not be physically present, such as freelancer's customers or the audience that consumes the news. The opinions and anticipated impressions and expectations of persons present or of other stakeholders on the used mobile system and the outcome of its usage can influence the user experience of a mobile reporter. The social acceptance of the used tool is important for users and it may differ based on the user group. Social acceptance may also change over time, as what is a curiosity first, becomes a part of the newsmaking activity as a part of the toolbox. Furthermore, culture and practice of journalism and participatory journalism or the culture of the organization in question incorporate values, norms and ideals, that can as a subcomponent of social context contribute to user experience.

Table 16. Summarized findings from publications on the social context.

Component	Definition (adapted from Jumisko-Pyykkö et al, 2010)	Findings related to sub-components (adapted from Jumisko-Pyykkö et al. 2010)	Publication(s)
Social	Other persons present physically or virtually, or other stakeholders of the activity or its outcome, their characteristics and roles, the interpersonal interactions and the surrounding culture.	The persons present in the situation classified to self, group, organization or public, physically or virtually present.	
		Interviewees, bystanders, peers (colleagues) present while interacting with the smartphone-based system	P1, P2, P3
	Added subcomponent:	Stakeholders not physically present while user interacts with the device	
		Editors, colleagues in the newsroom or from another newsroom, customers, audience/readers who asses the quality of the material or news (stories)	P1, P6, S4
		Culture – The macro level of social context including the values, norms, and attitudes of a certain culture, such as the work and organizational culture	
		Journalistic and news values, norms etc.	P1, P6, S2
		Profession related values, identity, ideal, norms etc.	P1, P6

5.1.3.5 Technology and information context

Technology and information context refers to the relation of other relevant systems and services to the user's interaction or activity with the mobile system. In case of journalism, this can include external components, such as microphones, keyboards and displays or alternatively, applications or services that can be used for mobile journalism. It also includes the wireless network with its attributes as well as the interoperativity in transferring data or material from one device to another or to the editorial system. Paper notebooks with hand-written information on preparations,

interview questions, and interviewee's quotes as well as plans for editing video footage are still today important informational artefacts for mobile reporters. In addition, smartphones enable with the available connectivity to the Internet an access to open information or organization's archives, for example. All in all, multipart and complex systems form ecosystems of devices and services that can contribute to user experience when used in mobile newsmaking.

Table 17. Summarized findings from publications on the technology and information context.

Component	Definition (adapted from Jumisko-Pyykkö et al, 2010)	Findings related to sub-components (adapted from Jumisko-Pyykkö et al. 2010)	Publication(s)
Technology and information	The relation of other relevant systems and services to the user's interaction with the mobile system	Other systems and services – the device, applications and the network related to the user's system or service (note: in this study components external to the smartphone or installed after purchase on the smartphone)	
		External components of a smartphone-based system, such as microphones and keyboards.	P2, P5, S1, S4
		Mobile journalism related applications	P1, P5, P6, P7, P8
		The wireless network and related attributes (availability, reliability, speed, interference)	P1, P2, P5, P6
		Interoperability between and across devices	
		Transferring data from one device to another or material delivered from the mobile system to the editorial system	S1, S2, S4
		Informational artefacts and access to other artefacts that contain relevant information	
		Notebooks	P1, P2, P6, P8
		Access to information via the Internet	P6

5.1.3.6 Properties of the context components

When approaching the properties of the context of use in mobile newsmaking three levels for context of use and its subcomponents can be identified in the results (P1, P2, P5, P6, P7, P9, S1, S2, S4): **macro-, meso-, and micro-level** (for discussion on levels of analysis see Yurdusev, 1993). Jumisko-Pyykkö & Vainio (2010) define these levels as the ***level of magnitude***. It covers all the context components: the task, temporal, social, physical and technology and information context.

The micro-level context of use is the individual level context of use, referring to the situation and its characteristics when a mobile reporter is interacting with the system while carrying out the activity of newsmaking. To exemplify the meso-level, social context is taken as an example. The meso-level of social context refers to the organization, community of practice or group. The macro-level refers to the context of journalism with its journalistic standards, values, practices, ethical codes and goals, as well as its role in society and the community it is reporting to. All levels can contribute to the user experience of a mobile reporter by framing goals and creating requirements, possibilities or constraints for mobile newsmaking.

The ***level of dynamism varies from static to dynamic*** (Jumisko-Pyykkö & Vainio, 2010) in the components of the context of use in mobile newsmaking, as exemplified in the following. The activity within which the interaction with the mobile system occurs may be hurried or idle. Unexpected breaking news brings urgency to newsmaking to publish news immediately online. The capturing of photos and video footage needs fast action and undelayed recording to "capture the moment". Fast movement, changes in the environmental conditions, such as lighting and ambient noise, may need attention and adjustment when shooting photos and video footage. The people around a mobile reporter may cause interruptions and disturbance by making contact with the

reporter or just passing by while talking loudly. The locations where newsmaking is carried out may change and the place of work may itself move, such as when in a moving vehicle, like a train. Artefacts, such as chairs and tables, may be available or not when editing the material in a mobile context of use. The network availability and speed of the connection may vary depending on the crowdedness of the area. The dynamism of the context of use can be supported by the mobile system with its features and functionalities. The related other systems can impact the perceived usefulness and suitability for the situation at hand.

The ***patterns in mobile newsmaking can have a regular rhythm or occur randomly*** (Jumisko-Pyykkö & Vainio, 2010). A regular workday with set deadlines for print publishing brings regularity to workdays. On the other hand, as events and happenings worthy of news reporting take place, such as breaking news about a big natural catastrophe or accident, the regular, a priori schedule and plan change due to the unexpectedness of the events. Certain types of news stories or themes are dependent on the time of year or have some other rhythm based on public holidays, or national or local elections for example (unpublished). The locations of mobile newsmaking can also have patterns, like focusing on local issues from a certain area at a certain time of the week or month. The week, in terms of news reporting and the topics that are covered by a mobile reporter within the week, may also have patterns. On a certain weekday, the focus may be on grab-them-by-the-sleeve-stories or on economic news (unpublished). When editing the material, a mobile reporter may search for a certain type of environment, for example a café, in which to carry out the work. Randomly happening unexpected events seem to fit the capabilities and strengths of smartphone-based systems in newsmaking. In regular reporting, unless some benefits, such as time-savings, of using smartphones are more strongly valued by a mobile reporter, other tools seems to be preferred that do not create unnecessary costs in terms of the produced quality.

An example clarifies how the context of use can contribute to user experience. The goal of news reporting is informing the public about current issues. Examples of the requirements and values in journalism are timely and truthful reporting. Constraints set by the organization are deadlines or the required immediacy of reporting directly from the event. The technology and information available for a mobile reporter to carry out newsmaking creates possibilities and at the same time may set constraints on the activity and the quality of the outcome. The ideals, needs, and goals of a mobile reporter may have different importance for him/her depending on the situation. The situation, defined as the "*relative position or combination of circumstances at a certain moment*" (Merriam-Webster), when using the smartphone-based system in newsmaking activity may 1) have patterns, 2) be dynamic, and 3) vary in terms of what level of values, norms, or ideals are important for the user at that moment in time. The 4) *combination of circumstances* (Jumisko-Pyykkö et al., 2010) describes characteristics of the context of use covering varying combination of components, subcomponents and properties of context use, that depend on the situation. The combination of circumstances can contribute to the requirements and needs of a mobile user, and determine the qualities that need to be met for the user to be satisfied with the system and find it appropriate for the activity.

5.1.4 Impacts of using smartphones in mobile newsmaking

The perceived or expected impacts are categorized to personal and newsmaking related benefits, as well as costs. They are summarized in Table 18.

One of the identified benefits for a mobile reporter was related to time-savings. They included shortening work days by enabling the efficient use of dead time in idle moments, such as when waiting or commuting, and reducing the need to travel to and from the newsroom. Mobile assignments were mentioned to create new work and reporting opportunities with expected monetary benefits (see section 5.2). Smartphones enabled the reporter to travel light, carrying only one small lightweight multipurpose tool. It was also easier to mingle with the crowd by using an everyday device. Mobile assignments were convenient as memory aids in the field, removing the need to carry paper along. The possibility of locating mobile reporters working in the field was expressed as increasing safety in dangerous areas, although it was also mentioned as a cost in the case of totalitarian countries. Smartphones were also found to be of benefit by creating job enrichment – by giving new opportunities for multimedia story creation, especially for journalists, and enabling new content of the work. Finally, having a makeshift available at all times for use in reporting breaking news was one of the most often mentioned benefits of smartphones when newsmaking.

From the point of view of news reporting and newsroom staff, one of the most important benefits for them was the increased speed and immediacy of news reporting. Should the reporter's location be used, it was expected to create benefits by supporting coordination of the newsmaking activity by keeping tab of the mobile reporters – facilitating the location of a reporter nearby a news event, as well as helping to locate another colleague with whom to jointly coordinate work in the field (see section 5.2). Another benefit was also expected from mobile assignments – they allow several reporters to be reached simultaneously when looking for someone to undertake a job, as well as allowing reporters to be reached instantaneously. The increased reliability of reporting was also suggested as a result of using the location information of the smartphones by attaching a geotag, date, and time information of photos and videos. This information could also be used for the enrichment of stories and to prove the authenticity of the material. Smartphones also enabled access to information in field conditions, e.g., by using the Internet to check for information on the interviewees or on the reported event. In addition, smartphones enabled following up news reporting and news coverage when mobile. These benefits exemplify the diversity of issues that can motivate the use of smartphone-based solutions in mobile newsmaking beyond the original purpose of use – synchronous communication with phone calls.

The most important cost was related to the lowered technical quality of the news items, especially of photos. Primarily for photos and video footage, the limitations related to the system were expressed to affect the content-based quality, leading to dissatisfaction with the produced outcome. Similarly, reduced control over capturing photos, due to missing adjustments and limited capabilities, reduced the number of captured photos and was described by some photographers to be demotivating and lowered their efforts. The limitations of smartphones were also expressed to restrict the use of skills and creativity, lowering the motivation to use a smartphone in newsmaking and enjoyment of the activity. This seems to be connected to the individual's need for achievement, defined as a "want

to accomplish reasonably challenging goals through their own effort" (McShane & Von Glinov, 2008, p. 141). Smartphones were perceived by some participants to affect a professional's job characteristics negatively (McShane & Von Glinov, 2008, p. 179), by reducing autonomy and the needed skills for the job. Concerns were expressed related to the changing roles and responsibilities of professionals, including concerns related to being able to do own job well. Some privacy concerns were raised in the case of locating reporters, but on the other hand, most participants found reporter location to be useful and acceptable in the context of newsmaking (see section 5.2). Generally, the comfort of working was reduced in reference to the ergonomics related aspects of working with a small handheld device. Face-to-face contacts with colleagues were missed, which would have usually taken place in the newsroom. Furthermore, some participants felt the boundary between work and free time would be blurred as a consequence of using smartphones in mobile newsmaking.

In summary, user's experienced quality of the system includes as a component the perceived impacts on user and newsmaking related benefits and costs. They can contribute to overall evaluative judgments as well as further consequences.

Table 18. The impacts of smartphone-based systems categorized as benefits and costs.

Benefit	Findings	Publication(s)
Personal benefit	The perceived or expected personal benefits related to Time-savings: efficient use of dead time, e.g. while waiting, commuting – P6, S2; shortening the work day by the reduced need to travel to and from the newsroom – P6 New work or reporting opportunities with monetary benefit: mobile assignments as a freelancer – P6, P7, and as a reader reporter or crowdworker – P8 Convenience: having only one small lightweight multipurpose tool to carry when mobile – P6; mingling with the crowd with an everyday device – P6; having mobile assignments as memory aids in field work – P7; freedom from paper – P8; ease of use; P1, P3, P5, P6, P8 Safety: An increased level of safety in dangerous areas by enabling location tracking– P7 Job enrichment: new opportunities in multimedia story creation – P6, S1, S4; new content of the work – P6, S1, S4 Having a makeshift: enables capture of newsworthy events with a device that is always brought along in cases where no other equipment is available – P6, S1, S2	P1, P5, P6, P7, P8, S1, S2, S4
The benefit for newsmaking	The perceived or expected benefits for newsmaking related to Speed and immediacy of reporting news: faster delivery of news directly from the event – P1, P6, P8. Coordination of reporting: keeping tab of the mobile reporters by being able to locate them – P7; locating a reporter nearby an event for reporting - P7, P8; reaching several reporters with mobile assignments – P7; reaching a reporter instantaneously with mobile assignments – P7; when working in the field, locating a colleague to coordinate work – P7 Increasing the reliability of reporting: location (geotag) and time of capture as proofs of the authenticity of the material – P7, P8 The enrichment of stories: with multiple media types – P6, S1, mapping a reporter online or on TV – P7 Access to information: e.g. background information on the interviewee from the Internet – P6, S1 Following up reporting and news coverage: when in the field – P6, S2.	P1, P6, P7, P8, S1, S2, S4
Cost	The perceived or expected costs related to Technical quality of the news content (text, photo, video, audio) and news – P1, P5, P6, S1, S2 The journalistic quality of the news content (text, story, photo, video, audio) and news - P1, P6, P8 Reduced control over capturing photos – a lowered number of captured photos P1, P8 Limits creativity and expression when capturing photo and videofootage – P1, P3, P4, P6, S2 Changes in job characteristics: undesired changes to roles and responsibilities due to the technology, e.g. by reduced autonomy – P6, P7 Privacy concerns: in the case of location tracking and geolocating reporters – P6, P7, P9 Reduced comfort of working: the ergonomics of using a smartphone in field conditions – P5, P6 The loss of face-to-face contacts with colleagues – e.g. in the case of mobile assignments – P6 The blurring of the boundary between work and free time – P6, P7	P1, P3, P4, P5, P6, P7, P8, P9, S1, S2

5.1.5 Journalistic quality and its relation to outcome and user experience

This section discusses and summarizes journalistic quality based on the findings of the studies. To understand the user experience in mobile newsmaking with smartphones and the findings of the studies, it is essential to understand news quality. It can be connected to the user's experience of the system quality.

Journalistic quality seems to have two distinct components: technical and content-based quality (P1, P5, P6, S2). The quality of the news material and published news is influenced in three phases of the mobile newsmaking: capturing, editing, as well as transmission.

Technical quality refers to the quality that is produced with the smartphone, or the entire system of news production. It is in the first place dependent on the smartphone-based system's characteristics. Technical quality includes the error-freeness of the text, including spelling mistakes. For photos and video footage as well as audio it includes the freedom from impairments or other quality lowering effects such as being out of focus or being overexposed. The network can cause further impairments, whereas editorial processes, including the actions by newsroom staff, can contribute to the quality positively in certain aspects, such as when selecting photos for publishing or checking the freeness of the text from typos.

Content-based quality refers to conforming to the journalistic qualities and the genre. It includes news values, ideals, and qualities related to newsworthiness such as immediacy and authenticity. Furthermore, it includes aesthetic, and communicative quality of the news material and news - text, stories, photos, audio and video footage - as well as the insightfulness of the combined narrative. It includes aspects such as the meaningfulness of the publication's content to the target group, relevancy of the news, visual appearance of the story and the publication, factuality and the ethical issues related to newsmaking. Content-based quality seems to depend, in the case of writing news stories, both on the technology and the knowledge and mental processes of the reporter (Picard, 2000), with the main emphasis on the latter. In visual reporting, the tool, for instance, a smartphone, can take the role of an enabler that supports and enhances the content-based quality of the reporting and, on the other hand, it can create constraints that can contribute to the content-based quality negatively. These two components (technical and content-based) of quality can contribute to the user's experience of the system quality in newsmaking with smartphones.

When approaching quality from the point of newsworthiness, the strengths of smartphones rest on the immediacy, authenticity, and timeliness of news reporting and the captured news material. The justification for using smartphones in newsmaking by professionals seemed to be studies of the thesis primarily the authenticity of the material and the need for fast publishing. In these situations the technical quality of the material plays a minor role. The everyday nature, the form factor, and relatively low cost of the smartphone enables the approach of news making and visual reporting from new angles. These aspects can be seen to positively contribute to the news quality.

On the other hand, professionals assessed the quality of the visual reporting enabled by smartphones against the quality of the publication in question. The quality of captured photos and videos was critically considered as to whether they thought it would satisfy the readers and fulfill their expectations of the quality of the visual reporting. Similarly, Dinka et al. (2006) conducted two

workshops with journalists to study how they envision the impact, i.e., the benefits and risks, of new journalistic tools and consumer devices on journalistic work. The desire to deliver good journalistic work had a high priority when considering impacts on audience experience. The assumptions about audience experience affected whether new technology was seen to be beneficial for the participants as news reporters or whether it was seen to be risky due to lowering quality (Dinka et al., 2006). The main benefit of new technologies in journalistic work was enabling the quick delivery of breaking news, whereas the main drawback was the risk of low quality (ibid.). However, if the news value was high enough, low quality would be accepted (ibid.). Therefore, journalists seem to consider the impacts of technology in terms of the newsworthiness, including the timeliness, of the material against the audience expectations towards the quality of the news delivered by the news publisher.

As readers' content is increasingly used in news media by hyperlocal, local, national, and global news media, the quality of news and news content may take on new meanings and be redefined. Therefore, there may be somewhat different requirements for the quality of the outcome, i.e., news content such as photos, depending on whether the reporter is a professional or a reader.

In summary, components of journalistic quality are technical and content-based quality. Smartphone-based systems can either enable or limit reaching the desired and acceptable level of the outcome quality that is dependent on the situation, i.e., the circumstances in the context of use. Created content quality can be influenced by the characteristics of the system in the following phases: capturing, editing, wireless transmission and editorial processes. The audience expectations and impressions are important when reporters evaluate the quality of outcome. The quality of outcome seems to contribute to the impressions of the system quality and to overall evaluative judgments as well as to the consequences of user experience.

5.1.6 System quality and overall evaluative judgments

Based on user's experience of using the system within the activity, users can express their impressions on the system quality by descriptive attributes. The perceptions of system quality can be moderated by the situation, that is, the combination of the characteristics of the context of use. Integrated perceptions of system qualities can contribute to overall evaluative judgments, which can be moderated by the characteristics of the user, system, the context of use and the tangible outcome.

System qualities that emerged as ***descriptive attributes*** and characteristics related to the system in the first study were grouped to two main groups following the approach of Hassenzahl (2003) and Mahlke and Thüring (2007): Instrumental (pragmatic) qualities and non-instumental (hedonic) qualities (P3, P4). The further studies provided similar findings on the expressed descriptive attributes of system quality and extended these findings.

Instrumental (pragmatic) qualities were originally grouped to two subgroups: 1) Usability and 2) Task and goal achievement (P3). The attributes in the group of "Usability", included qualities related to the use of the system such as simplicity, easiness, effortlessness, clearness, logicality, reliability and intuitiveness (P3). Task and goal achievement included the support for and effects on carrying out the activity and work. These characteristics included impacts on easiness of work, efficiency, support for goals, speed of publishing from the field, quality of the outcome, support for workflow, and speed of work (P3).

The non-instrumental (hedonic) qualities were categorized to two groups, namely 3) Stimulation and 4) Identification, as suggested by Hassenzahl (2003). ***Quality of Stimulation*** refers to system qualities that describe the excitement to activity or growth, or to greater activity (Merriam-Webster, retrieved 1.8.2013), referring in this case to skill and professional development, personal growth, and carrying out an activity, that is intrinsically motivating. Stimulation include characteristics such as restricting or inspiring, frustrating or exciting, discouraging or motivating, stimulating or preventing learning, limiting or enabling creativity, restricting development or offering challenges, and constricting or enabling professional ambition (P3). ***Quality of Identification*** addresses the signaling of personality (self-expressive symbolism; Crilly et al. 2004; Dittmar et al. 1995) and group membership and status (ibid.) using the tool as discussed in section 5.1.1. Furthermore, it relates to the social acceptance of the system. Identification includes characteristics such as professional or amateurish, unconvincing or credible, raising or lowering trust, increasing suspicion in or lowering the threshold of interviewees, lowering or promoting professional image, appreciation by professionals and lowering or enhancing respect for the work (P3).

The attributes that were related to overall evaluative judgments were categorized under subgroup 5) ***Appeal*** (P3, P4). It aimed to capture those aspects of evaluative judgments are integrated perceptions of the system qualities and can lead to consequences depending on the situation. Consequences can include system acceptance, impact on motivation to use the system and work satisfaction, actual usage of the system as well as effectiveness of the usage. ***Appeal*** included pleasantness, importance, goodness versus badness, attractiveness, seriousness or the relaxed nature of the system, interestingness, usefulness, and practicality (P3, P4). In addition to these characteristics, the ***suitability*** of the system was evaluated in the first study based on 1) daily use vs. as a makeshift, 2) for mobile journalism vs. not for mobile journalism, 3) professional use vs. hobbyist use, 4) as the only tool vs. as one tool in a professional's toolbox and 5) for direct online publishing from the field vs. for edited online publishing. The results in the first study revealed that the system was evaluated by most respondents to be suitable as a makeshift (9/15), for mobile journalism (12/15), for edited online publishing (10/15), and as one tool in a professional's toolbox with other tools (15/15). Similar findings were found in the other studies of the thesis work (see P6).

However, in the course of the thesis work as new findings emerged and the understanding of the mobile newsmaking as an activity as well as of the theory deepened, it became clear that there is a need to restructure the original groups of instrumental qualities and rename the group of Appeal to **Overall evaluative judgments** to emphasize the overall judgment of the system quality by the user. In case of the instrumental qualities the aim was to clarify the distinction between attributes describing the system and its characteristics when the system is used within the newsmaking activity from the attributes describing quality of the outcome and impacts of the system. ***This clarification by restructuring and renaming aimed to support the construction of the model of user experience for mobile newsmaking that is presented in the end of this chapter*** (section 5.3). The restructuring was done as follows.

Instrumental quality refers to the user's impressions on the experienced quality of the system when interacting and using it within the newsmaking activity that are described with descriptive

attributes. It includes as the first component the ***Quality of Interaction***, which is the user's experienced quality of the interaction with the system. The second component is the ***Quality of the Newsmaking Activity***, which is the experienced quality of using the system in the newsmaking activity and its subactivities. These two components are complemented in the next section of this chapter with two further components, which emerged when studying cooperative aspects.

Separate groups of qualities were created for the impacts and outcome of system use. The **Quality of the outcome** refers to the user's experienced quality of the tangible outcome described with descriptive attributes when he/she has used the system in the newsmaking activity with specified goals. Quality of the outcome comprises of two subcomponents: technical and content-based quality. **Perceived impacts** of the system refer to the benefits and costs the user perceives in relation to the system and its usage on him/herself (individual), newsmaking, and tangible outcome.

As a summary, four groups for the descriptive attributes were identified for the user's experience of the system quality: instrumental and non-instrumental qualities as well as the quality of outcome and perceived impacts. Overall evaluative judgments are integrated perceptions of the system qualities. The characteristics of the user, system, context of use and the tangible outcome can contribute to the overall evaluative judgments. The perceptions of system qualities and the overall evaluative judgments can lead to consequences.

5.1.7 Summary

The characteristics of the user, system, the context of use and the tangible outcome can contribute to user experience in mobile newsmaking with smartphones. The user's impressions of the experienced quality of the system are described by *descriptive attributes (qualities)* that are related to the system, outcome and impacts. Perceptions of the system quality can contribute to the overall evaluative judgments of the system. Descriptive attributes and qualities of the overall evaluative judgments can be used to measure the degree to which the user is satisfied with the system depending on the requirements and needs of the user in a specific situation.

The user (the mobile reporter) is the person who controls and manipulates the smartphone in a mobile context of use during the activity of mobile newsmaking. The findings indicate that professionalism, the motivation for use, professional identity, prior experiences, personality, and expertise in photography can contribute to user experience.

The system comprises of a mobile system, a wireless network, and editorial systems. The mobile system has a smartphone as the main component that can be connected to external components and devices wirelessly or by cable (such as a keyboard or a microphone) and it can have mobile applications or mobile service clients installed on the device. The findings indicate that the characteristics of the system features and functionalities that can contribute to user experience are related to the display, the text entry method (including the keypad or keyboard used), the form factor, the battery life, the processing and memory capacity, multimedia components, mobile applications and services, the available multifunctionality of the smartphone, the wireless network, information, and the type of communication (synchronic or asynchronic).

The context of use refers to the circumstances in which the activity of mobile newsmaking takes place. The findings on circumstances reported in the publications were categorized into five context

components (temporal, task, physical, social, and technology and information contexts) and their sub-components and properties were described.

Tangible outcome refers to the object (news material or news) that is captured, created and/or edited with the smartphone or that is the output of the whole system, including the transmission via the wireless network to the editorial system and finally the possibly post-processed and published version by the newsroom staff.

Descriptive attributes, which describe the user's impressions on the system quality, include four main groups: instrumental and non-instrumental qualities as well as the quality of the outcome and perceived impacts. Instrumental qualities comprise of the Quality of Interaction and Quality of the Newsmaking Activity. Non-instrumental qualities include the Quality of Stimulation and Quality of Identification. The Quality of the Outcome comprises of the technical and content-based quality of the news content and news. Perceived impacts include impacts on newsmaking, on the mobile reporter (individual) and on the outcome (i.e., the news items and news).

Overall evaluative judgments are integrated perceptions of the system qualities (descriptive attributes). The characteristics of the user, system, context of use and the tangible outcome can moderate the overall evaluative judgments. The perceptions of system qualities and the overall evaluative judgments can lead to **consequences**.

Next, the findings from the cooperative newsmaking related to assignment-based processes are presented. Finally, a synthesized model of user experience is presented in the end of the chapter based on the findings related to both research questions.

5.2 How can mobile and location-based assignments support cooperative newsmaking?

Studies on mobile and location-based assignments delivered to smartphones addressed assignments 1) for professionals who would work as employees or freelancers (P7) and 2) for crowdsourcing news photos and video content from the readers (P8, P9). When studying use of assignments aiming for professional use, the participants used a mobile client prototype that enabled receiving mobile assignments and submitting material to the assignments in two field studies (P7). In the case of crowdsourcing, the perceptions of reader reporters were first collected based on scenarios and with interviews (P8, P9). Post-experiments interview and questionnaire were used in data collection in a quasi-experiment in field conditions that used simulated location-based assignments delivered as SMS messages (P8, P9).

The following sub-sections answer the research question on how mobile and location-based assignments can support cooperative newsmaking. The studied solution for locating the whereabouts of a mobile reporter was based on newsroom staff tracking the location of the mobile reporter's smartphone. For location-based assignments a push-type of solution, in which the assignments are pushed to reporters in a certain area or location with the help of their smartphones, was addressed.

5.2.1 Mobile users' perceptions on mobile and location-based assignments

The results on the perceptions on mobile and location-based assignments based on qualitative analysis of the collected data relate to the following key issues: the elements that contribute to the *acceptability* of the use of mobile and location-based assignments and the *perceived benefits and costs* for the mobile users and newsmaking in the cooperation (P7, P8, P9).

For the acceptability of locating the reader's mobile phones and delivering location-based assignments based on the location, the results indicate that in implementation it is important to take into account the *privacy concerns* raised by the study participants. The privacy concerns were related to remaining in control of the availability for receiving assignments, undertaking assignments, as well as the location being tracked – both in professional setting as well as when using crowdsourcing (P7, P9). Furthermore, the use of mobile assignments for briefing simple short stories and in fast reporting situations was considered acceptable by participants (P7). For more complex types of story or for other situations briefing by mobile assignment was not found feasible due to the felt need for discussion and negotiation when on a more complex topic (P7).

The perceived benefits of mobile and location-based assignments *for mobile users* included ease of use (P7, P8), handiness or practicality in a mobile context of use (as no paper is needed and mobile assignments can be used as memory aids to support reporting) (P7, P8), quickness (P7), cost-effectiveness and gained time-savings due to removed need for traveling to and from the newsroom (P7), reception of tip-offs about what the newsroom is interested in (P7, P8), and the possibility for getting a reward for carrying out an assignment (P8). As for the negative aspects of using mobile phones to receive mobile assignments, the participants who were used to traditional newsmaking process in a professional context mentioned the prevention or disruption of communication (P7), disturbance of the reporting process (P7), inefficiency (P7), constraint of the reporter's own instincts and creativity (P7), reducing the amount of autonomy and lowering the required skills for reporting (P7), and perceiving no benefit (P7). Both benefits and costs were addressed by participants.

In the case of professionals usage of the newsmaking location was found useful (P7). Most participants found locating of professional reporters based on their mobile phone location useful when the newsroom locates reporters in the field, reporters can locate each other, or if the reporters could locate their informants (P7). Locating of reporters was on one hand found to increase the safety of a mobile reporter in dangerous areas (P7). On the other hand a few participants feared that the location information might end up in the wrong hands (P7, P9), be misused (P7, P9), or might even compromise the safety of the reporter (P7, P9) as well as the informant in totalitarian countries (P7). These concerns address privacy and security.

The perceived benefits *for the newsroom* when using mobile and location-based assignments were the following: to reach a reporter instantaneously, independent of his/her whereabouts (P7); to reach several reporters simultaneously to find someone to undertake a task (P7); to reach a reporter close to the scene of reporting (P8); to speed up news reporting and get content faster than by sending a reporter from the newsroom to the scene (P8); and to prove the authenticity of the material and thereby increase the reliability of the reporting (P8). It was mentioned that when there is one known professional who is receiving the assignment, a phone call would be easier for clarifying the

assignment and making sure that the person is undertaking the task rather than using online tools to send the assignment and to follow up the process and its undertaking (P7). In addition, some participants emphasized the importance of person-to-person synchronous communication (P7), that could not be replaced completely by mobile assignment-based solutions.

Both benefits and costs were identified related to using mobile and location-based assignments. On one hand, they were found useful, easy to use, suitable, offering reporting opportunities for freelancers and readers, and provide benefits for cooperation in coordination of reporting and communication for the mobile users, for the newsroom as well as for newsmaking. On the other hand, reducing the autonomy of a professional's work was feared, and privacy concerns related to the tracking of the reporter location were raised. Furthermore, it was feared that the possibility for negotiation and clarification of the assignment would be degraded due to the inefficiency in communication caused by asynchrononity of the communication. Privacy issues are discussed in the next subsection in relation to the participation preferences.

5.2.2 Factors contributing to mobile users' participation preferences

The results indicate that the following elements contribute to participation preferences of the mobile users when using mobile and location-based assignments: the characteristics of the mobile context of use, the characteristics of the assignments, and the perceived benefit or risk of sharing the location information of the mobile phone for newsmaking (P7, P9, Appendix 5).

Privacy concerns were raised in the interviews and questionnaire responses on locating professional's whereabouts based on tracking their mobile phone location and using the location information for delivering location-based assignmentss (P7, P9). On one hand, participants were concerned for their privacy in general (P7, P9) and many participants expressed feeling uncomfortable about someone locating their whereabouts (P7, P9). The expressed concerns were related to revealing personal daily patterns and private locations that they were not willing to disclose to others (P7, P9). On the other hand, in the case of crowdsourcing of news content a majority of participants did not find it especially risky to give the newsroom permission to locate their mobile phone (P9, Appendix 5), and the use of location information was assessed by a majority of participants more beneficial than risky (P9, Appendix 5).

Table 19 presents the framework for studying the characteristics of the context of use when exploring the mobile users' participation preferences with a questionnaire at the end of the field experiment (P9). In the case of crowdsourcing (P9), the most preferred task types by participants were simple tasks, such as shooting a photo or a video clip. A majority of participants also agreed to writing a news story (P9). When receiving location-based assignments participants preferred a relatively short vicinity, less than 1 km, to the reporting location (P9). Participants preferred approximate (e.g., neighborhood) and vague (e.g., town) locating, and a combination of anonymous and precise locating when sending location-based assignments (P9). Precise combined with unanonymous locating was less preferred, although over half of the participants agreed to it (P9).

The most preferred situation to receive location-based assignments was when there was no parallel task, that is, when there was nothing else to do (P9). Temporal preferences for receiving a

location-based assignment varied, but both daytime and evenings were the most preferred times (P9). The organization type was not found to contribute to the participation preference in this study, as all participants were almost equally willing to agree to tracking their location by either a local or national news publisher (P9). When interviewed on the location-based assignment scenarios, some of the interviewed readers mentioned possible monetary benefit as affecting their willingness to allow tracking their location in case of location-based assignments (P9).

In case of reader reporters (Appendix 5, P9) the privacy concern score revealed that participants were generally concerned for their privacy. However, the perceived risk versus benefit of sharing the precise location with the newsroom (Appendix 5, P9) revealed that most of the participants found giving the permission to the newsroom to locate their mobile phone at least somewhat more beneficial than risky. This item was also positively correlated on a statistically significant level with willingness to share precise and approximate location (Appendix 5). Item therefore seems to give an indication of the willingness to reveal user's whereabouts to the organization asking for the location information. It seems that the perceived benefits of allowing locating by the newsroom seem to be considered greater than the perceived risks in case of reader reporters.

In the case of professionals as mobile users who receive mobile assignments and location-based assignments, the information on the number of receivers, that is, whether the reporter was the only one or whether the assignment was sent to a larger group, was mentioned to affect the attitude towards the assignment (P7). The results presented in the previous subsection indicate that the perceived usefulness and added value compared to the traditional practice of calling, and the perceived benefits for the mobile reporter and newsroom, as well as for newsmaking generally (see Table 18), contributes to the willingness to receive mobile and location-based assignments.

Table 19. A framework for characteristics of the context of use that can contribute to participation preferences in case of mobile and location-based assignments (adapted from P9).

Component of context of use influencing preference	*Description*	*Used item themes (P9)*
Temporal context	The time when the reporter is willing to receive assignments	Anytime Weekdays Weekends In the daytime Evenings
Physical context	The location in which the reporter is willing to receive assignments	Anywhere Downtown
	The vicinity to the scene of reporting in assignments	When the distance is less than 1 km from the scene of reporting When the distance is less than 5 km from the scene of reporting
	The precision of the location query willing to agree to to receive assignments	Precise geolocation (i.e., address, place) Approximate (district, neighborhood) Vague (city) Anonymous, but precise
Task context	Accepted parallel task when receiving assignments	When there is nothing more important to do During free time When working or studying
	Assignment characteristics wiling to carry out: type of content and contributions asked for, that can vary in terms of complexity and needed effort, as well as incentive	Write a news article Conduct an interview Shoot a photo Shoot a video clip
Social context	Social situation when receiving assignments	When alone When in the company of others
	Organization characteristics: the type of news organization sending the LBA	Local news publisher National news publisher

The framework presented in Table 19 includes four context components (temporal, physical, task, and social), as well as their description and operationalization in the twelth study. As a fifth context component the technology and information context could be added to include the implementation of locating mobile reporters, and the information related to the assignment.

Results indicate that mobile reporters can see more benefit than risk in sharing their location with the newsroom. Possibility to control availability in the case of push assignments both in case of mobile and location-based assignments can decrease the privacy concerns of the users. To mitigate the privacy concerns, supporting the pulling of assignments instead of pushing them, is likely to reduce the privacy issues as the control is on the user's side. The presented framework for characteristics of the context of use that can contribute to user participation can be used, validated, elaborated and extended in further studies on participation when using mobile and location-based assignment processes in work and crowdsourcing settings.

5.2.3 Supporting mobile assignment-based cooperation

This subsection presents the identified needs (P7-P9) and descriptive qualities related to designing mobile assignment-based cooperation processes as well as systems supporting these processes in newsmaking. First, identified needs for the system support from the point of the newsroom staff are described. Next, the critical issues related to the mobile assignments for the mobile reporters are discussed. Finally, two groups of descriptive attributes for the model of user experience are defined related to the cooperative processes and information.

The results showed that the *newsroom staff* that create the assignments for planned reporting to mobile reporters needs support for

1) identifying the potential receivers of the assignments when assignments are directed to one or a few selected reporters to cover the story: based on their availability, profiles (equipment, skills, special expertise or interests), and location in case of location-based assignments (P7),
2) creating structured information (see Table 20) for assignments, to minimize the risk of forgetting important information from the assignment (P7) and to reduce the need for communication to clarify basic factual information (P7),
3) situation-awareness (Endsley, 1995) – in relation to the status of and following up on a) the undertaking of the assignments by reporters (was assignment received and read or not; understood or needing clarification; undertaken or not) and b) the progress of reporting to assignment, in order to be able to act on and make decisions and changes to reporting plans based on the available information and in relation to the changing overall situation of news reporting (P7),
4) synchronous and asynchronous communication in the case of needing to clarify, negotiate and update information between the newsroom staff and mobile reporters related to the reporting (P7),
5) updating of the assignments with new information such as asking for further reports (P7) or giving updates on background information, and

6) the means for the dynamic coordination of collaborative reporting situations when multiple reporters jointly cover a story with the help of assignments (P7) or when reporters in the field identify a need for extra help (P7), such as special skills or equipment. These collaborative reporting situations could involve readers as reporters as well.

For the *mobile reporters* the critical issues that were emphasized in relation to the mobile assignments were related to

7) the informing of the new incoming assignments (Sarjala, 2010), updates to assignments, and confirmation of the completion of the assignment that could be implemented with visual, audio or haptic notifications, for example,
8) providing information related to the assignment properties that are presented in Table 20 (P7) should ideally to be structured in order to be able to use it as a checklist in mobile context and to support the decision of whether to undertake a task or not (P7),
9) enabling updates to the created reports (P7), including a possibility to drip-feed material to be published as the story develops,
10) supporting synchronous and asynchronous communication to clarify and negotiate assignment and reporting related issues (P7),
11) enabling control over availability for carrying out assignments as well as tracking the location of the reporter and its precision (P7, P9), and
12) supporting following up of the submission and publication process and getting feedback and confirmations (P7, P8).

Table 20. Identified information needs categorized as the properties of mobile and location-based assignments.

Property	*Identified information needs*	*Publication(s)*
Topic	A general description of the assignment topic to be covered or the title of the story	P7
Target group	The group of receivers and no. of wished reporters (one, several, or open call)	P7
Validity	The schedule, deadline	P7, P8
Type of reporting	One time, drip-feeding etc.	P7
Incentive	The reward (amount, value, type) The mechanism for rewarding	P7, P8 P7
General information	The location (address) The event to be covered Information on interviewee(s)	P7 P7 P7
Content asked for	The type of content (e.g., text, photos, video, audio) The length of text (e.g., as a number of characters) The number of photos and video clips The length of audio and video clips The desired quality or other special requests for media content	P7 P7 P7 P7 P7
The type of the story	The type described as the intended department or category in the publication or using journalistic language and/or the language of publications' staff, such as main/local news, column, first page, feature, short interview, premium, street gallup or a "grab them by the sleeve" profile.	P7
Special requests on the story	The viewpoint or perspective to take when covering the story - for instance, a lead – or whether it is up to the reporter to decide this	P7
The intended usage of the story/material	The intended usage channel of the material (online, print, TV, radio/audio)	P7
Special requests on media content or story	What is wanted as the object, target, athmosphere or angle of capturing photos or videos, as examples of the possible requests (note: identified needs unpublished)	P7
Background information	Links to: information, old articles, etc.	P7

In terms of user's impressions as descriptive system attributes, findings can be divided to two parts from the point of cooperative newsmaking:

1) ***Quality of Information*** – refers to the communicated information with different medium (written mobile assignments, phone calls, social media, system information on the process phase, feedback for actions etc.) and its appropriateness to use (such as synchronisity) is dependent on the mobile users' needs in a situation, and

2) ***Quality of Cooperation*** – refers to the support for the coordination of newsmaking activities, such as locating reporters and awareness of reporters' activity; collaboration such as when exchanging knowledge about a topic; cooperation such as when reporting jointly as a larger group which may include professional and/or reader reporters.

The results reveal needs for the information content in the assignments that are presented in Table 20 (P7, P8). The information content of the news briefings mediated by mobile and location-based assignments can contribute to the perceptions on the Quality of Information. Information content of the news briefings should therefore be taken into account in assignment design and when designing the mobile and location-based assignment processes and supporting systems for creation of the assignments by the newsroom. A structured assignment design for mobile reporters' user interface would help in creating clear and sufficient information in the assignments that facilitates the use of mobile and location-based assignments (P7) and supports the mobile user as a memory aid of the assignment in mobile context of use (P8).

5.2.4 Summary and a process model for mobile assignments

As a summary, mobile and location-based assignments were perceived to support cooperative newsmaking in case of relatively simple assignments and they were found easy to use. Mobile and location-based assignments create both benefits and costs for the mobile users and cooperation in mobile newsmaking. Readers get benefit by being able to cooperate in a new way with the newsroom. Professionals get benefit by the support for the coordination of the reporting, and providing a new way to communicate the news briefings. Costs are related to the privacy concerns both in case of readers and for professional use when locating of reporters is used. In professional use it was feared that the autonomy of work is reduced. In addition, challenges and inefficiency of asynchronous communication and negotiation of the news briefings were raised. Most participants perceived the benefits of allowing the newsroom to track the location of mobile reporters based on their smartphone location to be greater than the risks of sharing location information.

The descriptive attributes related to using mobile and location-based assignments were divided to two groups. **Quality of information** refers to the quality of the communicated information and knowledge with different medium and solutions. **Quality of cooperation** covers the quality in coordination, communication, collaboration and cooperation (see section 3.1.4 and Neale et al. 2004 for definitions) in newsmaking activity.

Based on the findings of the studies, a process model for mobile and location-based assignments is presented that captures main phases within the process from the viewpoint of newsroom and mobile reporter that is presented in Figure 17. It summarizes the thesis work on cooperative

processes in mobile assignment-based newsmaking for the journalism industry and for solution designers and developers. It is shortly described next.

In a mobile assignment-based process, the newsroom staff initiates the process by creating an assignment based on a newsworthy event or story needing reporting. Assignment can be complex, covering a whole story, or simpler for getting certain type of material for news, such as photos, information, or tip-offs for news, for example. When creating an assignment the assignment properties need to be described (Table 20) to ensure that the received material confirms to the needs of the newsroom. If the requirements are flexible, or freedom and creativity is encouraged in carrying out the assignment, it should be stated clearly. When the target group or individual is selected or assignment openly shared to the public, and the location of the assignment is set for location-based assignments, the assignment is distributed.

The mobile reporter either receives a push notification (visual, haptic, audio) of the new assignment or searches for available assignments when convenient. Notifications and search of assignments can also be based on the mobile phone location. If requested, the mobile reporter should confirm whether he/she undertakes the assignment and intends to carry it out. Next, the mobile reporter moves to carrying out newsmaking related activities and tasks (see also Figure 11) - either immediately, when requested, or when convenient for the mobile reporter.

The newsroom staff follows up the progress of reporting and incoming material, how actively contributions are submitted, and whether any challenges or changes occur that need attention and action by the newsroom. The intensity of the follow-up depends on the type of news in question (e.g. breaking news), how publishing has been planned and scheduled, and whether the reporting involves several mobile reporters and newsroom to work cooperatively to cover the news. However, the goal especially in crowdsourcing of news is to minimize the communication and direct it to be mediated with the mobile assignments and their updates. The goal from the organization and newsroom point of view is to ensure and improve cost-effectiveness and create time-savings.

When the mobile reporter submits the material, he/she expects to receive various confirmations and feedback. Some of these confirmations and feedback can be automated, while others need to be taken care of by the newsroom. The confirmation of the successful transmission to the newsroom and the editorial systems can be automated. The acceptance of the material needs to be confirmed by the newsroom and sent to the mobile reporter. If the newsroom staff has further needs for reporting or information on the material, they can be sent through the updates of the assignment when supported by the solution and the process. When the reporting has been completed, the newsroom staff is satisfied with the material and information, and no further requests are created, a confirmation for the completion of reporting can be generated by the newsroom in case of more complex assignments. When a confirmation of the completion of the reporting is sent to the mobile reporter, he/she can then leave the scene. Mobile reporters, especially reader reporters, are also interested to get information when and where their material is published as well as information about their reward. Furthermore, acknowledging the participation of readers is needed to keep up the motivation of the readers in the participation (see Jaakola 2012, Väätäjä et al. 2013). These needs could be supported by the solution and processes related to mobile assignment-based newsmaking processes.

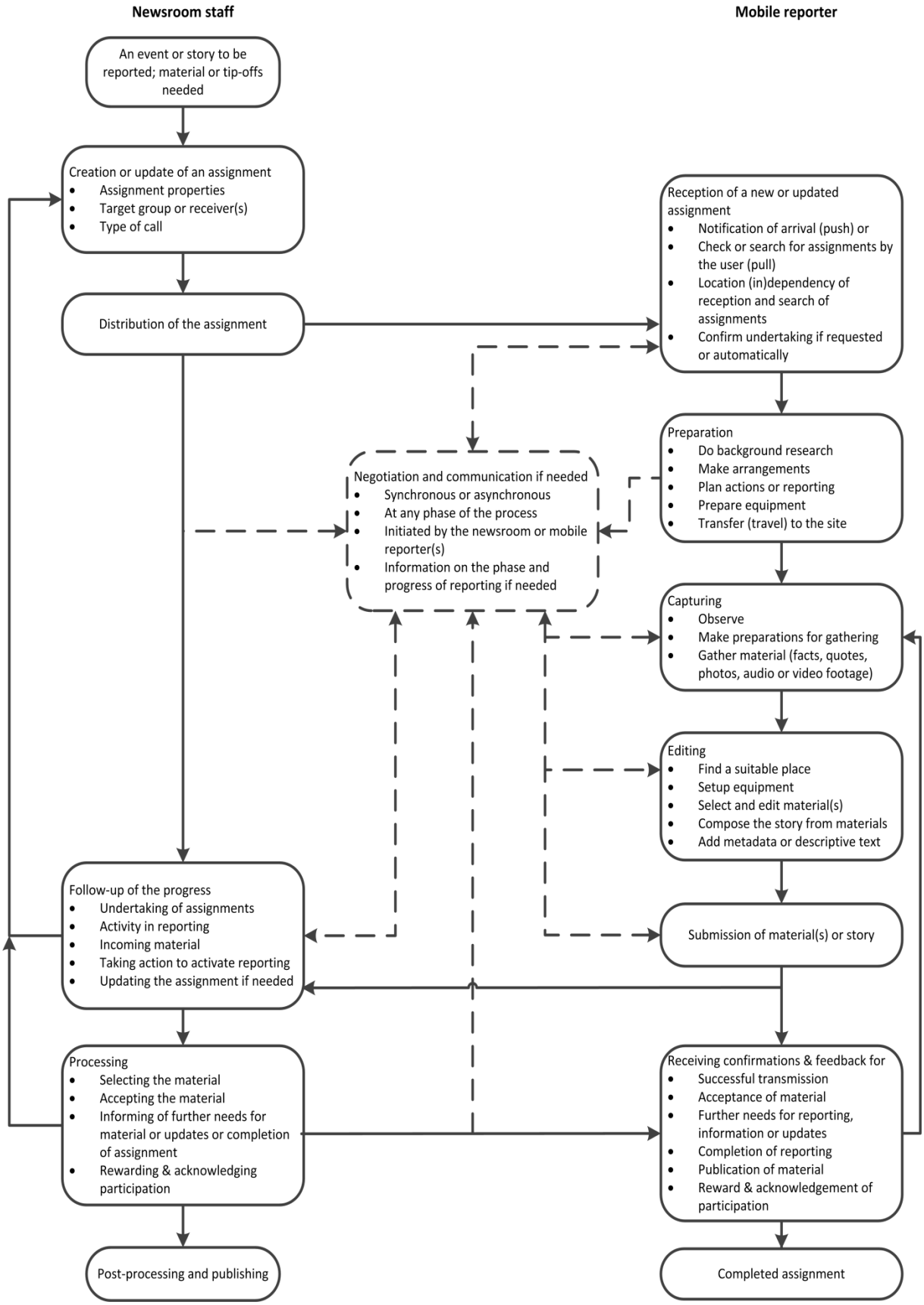

Figure 17. A process model for mobile assignment-based news reporting.

5.3 A model of user experience in mobile newsmaking

This section presents a model of user experience in mobile newsmaking with smartphones. The model is a synthesis of the empirical research results presented in this thesis summary and prior models related to user experience from the fields of HCI and IS presented in Chapter 2. The model extends and elaborates the previous models of user experience based on the findings of the thesis work on mobile newsmaking with smartphones.

User experience in mobile newsmaking is constructed in a process of using the mobile system in a goal-oriented and creative activity in the context of use. As a result of the findings from the studies and prior definitions and models of user experience, user experience is defined as follows:

User experience is the consequence of motivated action and interaction with the system that has goals specified by the user, organization, and other stakeholders, as well as by the circumstances within which the activity takes place. The experiential components of user experience include the user's impressions and reactions related to the system, the tangible outcome of system use, the impacts of the system, and overall evaluative judgments. The characteristics of the user, system, the context of use and the tangible outcome can contribute to user experience.

The model of user experience in mobile newsmaking with smartphones is presented in Figure 18. It includes *seven main components: user, system, the context of use, tangible outcome, descriptive attributes, overall evaluative judgments, and consequences*. The experiential dimensions related to user experience include user's verbally expressible descriptions of the system quality as *descriptive attributes*. The descriptive attributes are divided to four parts: *instrumental and non-instrumental qualities* related to the system*, the quality of the outcome* of using the system in the activity*, and perceived impacts* of the system use. The descriptive attributes can contribute to *overall evaluative judgments.* In addition, the characteristics of the user, system, the context of use as well as the tangible outcome can moderate *overall evaluative judgments*. The components of overall evaluative judgments of the system are appropriateness to use, enjoyment of use, enjoyment of goal achievement, and excellence (quality of being outstanding). The impressions and perceptions of system and outcome qualities, the perceived impacts, and the overall evaluative judgments can lead to *consequences*. The characteristics of the user, system, the context of use and the tangible outcome can moderate the consequences.

The contributions of the model in terms of the components and subcomponents are the following. The model extends the reviewed models of user experience from the field of HCI by tangible outcome as one of the main components contributing to user experience. Furthermore, it introduces two novel groups of descriptive attributes to the reviewed user experience models in the field of HCI. These groups of descriptive attributes are the quality of the outcome (comprising of technical and content-based quality) and the perceived impacts of the system and its use (on individual, newsmaking. In addition, instrumental (pragmatic) quality is divided to four parts based on the thesis work to emphasize the multiple aspects of the system that can be important for the users when using the system within the mobile newsmaking activity and its subactivities. These include quality of interaction, quality of the newsmaking activity, quality of information and quality of cooperation.

The components and subcomponents of the model are described next.

The user (the mobile reporter) is the person who controls and manipulates the smartphone-based system in a mobile context of use within the activity of mobile newsmaking. The findings indicate that professionalism, the motivation for use, professional identity, prior experiences, personality, and expertise (skills), especially in photography, can contribute to user experience (see section 5.1.1).

The system comprises of a mobile system, a wireless network, and editorial systems. The characteristics of the system that can contribute to user experience are presented in section 5.1.2. The ease of use, simplicity and portability of the tool, its reliability, the comfort and speed of carrying out the activity or subactivity (e.g. writing, capturing, editing, submitting), and the quality of the outcome when using the system within the activity of mobile newsmaking were important for the participants.

The context of use refers to the circumstances in which the activity of mobile newsmaking takes place. The findings on circumstances reported in the publications were categorized into five context components (temporal, task, physical, social, and technology and information contexts) and nineteen subcomponents according to the CoU-MHCI model by Jumisko-Pyykkö et al. (2010) in section 5.1.3. Three extensions to subcomponents were identified in the empirical findings.

Tangible outcome refers to the object that is captured, created and/or edited with the smartphone or that is the output of the whole system, including the transmission via the wireless network to the editorial system and finally the possibly post-processed and published version by the newsroom staff. In case of newsmaking, a tangible outcome can be material for the news, such as a tip-off for news reporting, a photo, audio or video footage, text in various lengths and forms, as well as whole stories compiled of materials. The desirable characteristics of the tangible outcome are defined by the requirements of the user, organization or journalistic culture. They can be used as a reference for evaluating the produced outcome.

Descriptive attributes are verbally expressible features of quality as experienced by the user. Descriptive attributes are divided to four parts.

1. *Instrumental quality* (pragmatic quality) refers to the experienced quality of the system and its use in the newsmaking activity (sections 5.1.4 and 5.2.3). It comprises of four subcomponents of experienced qualities (descriptive attributes as described by the users based on their experience), that are 1) interaction with the system (Quality of Interaction), 2) use of the system in the newsmaking activity and its subactivities (Quality of the Newsmaking Activity), 3) information in terms of presentation (format), access, completeness, timeliness, clarity and accuracy (Quality of Information), and 4) cooperation on different levels related to the coordination, communication, collaboration, and cooperation (Quality of Cooperation).

2. *Non-instrumental quality* (hedonic quality) refers to the user's experienced quality of the system in relation to self that satisfies user needs beyond the instrumental value (section 5.1.4). It has two subcomponents of qualities. Experienced quality of stimulation includes attributes on encouraging to personal development (e.g. skills, knowledge), and enabling creativity, ambition and learning (Quality of Stimulation). Experienced quality of identification refers to the quality of self-expression, user's and group's identity and image as well as the effect of the used tool on these (Quality of Identification).

3. The *quality of the outcome* refers to the user's experienced quality of the tangible outcome when using the system in the newsmaking activity with specified goals (section 5.1.4). Quality of the outcome has two subcomponents: technical and content-based quality. Technical quality includes aspects such as freedom from typos in written text, sharpness, contrast and artifacts of photos, as well as artifacts in transmitted video footage. Content-based quality refers to content related aspects of storytelling, i.e., the communicativeness, expressiveness, interpretativeness, and insight, by the means of text, audio, visual or audio-visual materials. Furthermore, content-based quality refers to the newsworthiness of the material based on various criteria discussed earlier. Quality of outcome can be described in the following phases: when captured and/or edited with the mobile system, after submission and after publishing. At all of these phases, different system related characteristics may contribute to the quality of outcome and how the users describe the outcome after the phase.

4. The *perceived impacts* of the system refer to the benefits and costs the user perceives in relation to the system and its usage within the activity (section 5.1.5). The perceived impacts are divided to three subcomponents, based on the object that the system has an effect on. First, user perceives impacts on individual level, such as time-savings, convenience of usage, and job enrichment. On the contrary, the impacts be experienced negatively, such as negative effects on own job characteristics. Second, the system can be experienced to have impacts on newsmaking, including changes in how the activity is coordinated, effect on reliability of the material or speed and immediacy of news reporting. Finally, the user can perceive impacts on the tangible outcome of system usage. He/she may compare the outcome with other systems that can be used for the activity. The system may increase the authenticity and timeliness of the material and therefore the newsworthiness, or lower the technical quality of the material or its expressiveness, for example.

The instrumental and non-instrumental system qualities, the quality of the outcome, and the perceived impacts can contribute to **overall evaluative judgments**. Overall evaluative judgments can be moderated by the characteristics of the user, system, the context of use and the tangible outcome. The components of overall evaluative judgments of the system are appropriateness to use, enjoyment of use, enjoyment of goal achievement, and excellence. Appropriateness to use is the quality of fulfilling the instrumental requirements to use. Enjoyment of use is the quality of fulfilling the non-instrumental needs of the user. Enjoyment of goal achievement is the quality of pleasure by achieving the specified goals that are meaningful to the user. Excellence refers to the quality of the system being outstanding.

The impressions and perceptions of system and outcome qualities, the perceived impacts, and the overall evaluative judgments can lead to **consequences**. Consequences can include system acceptance and usage behavior (e.g. frequency, effectiveness), increase or decrease of the motivation to use the system, and it can also lead to consequences related to job satisfaction or participation to crowdsourcing, for example.

The presented causal links in the model are based on the reviewed theoretical models from HCI and IS in Chapter 2. The consequences and its subcomponents have not been in the central focus of the thesis work, although the themes of the subcomponents emerge in the empirical qualitative data.

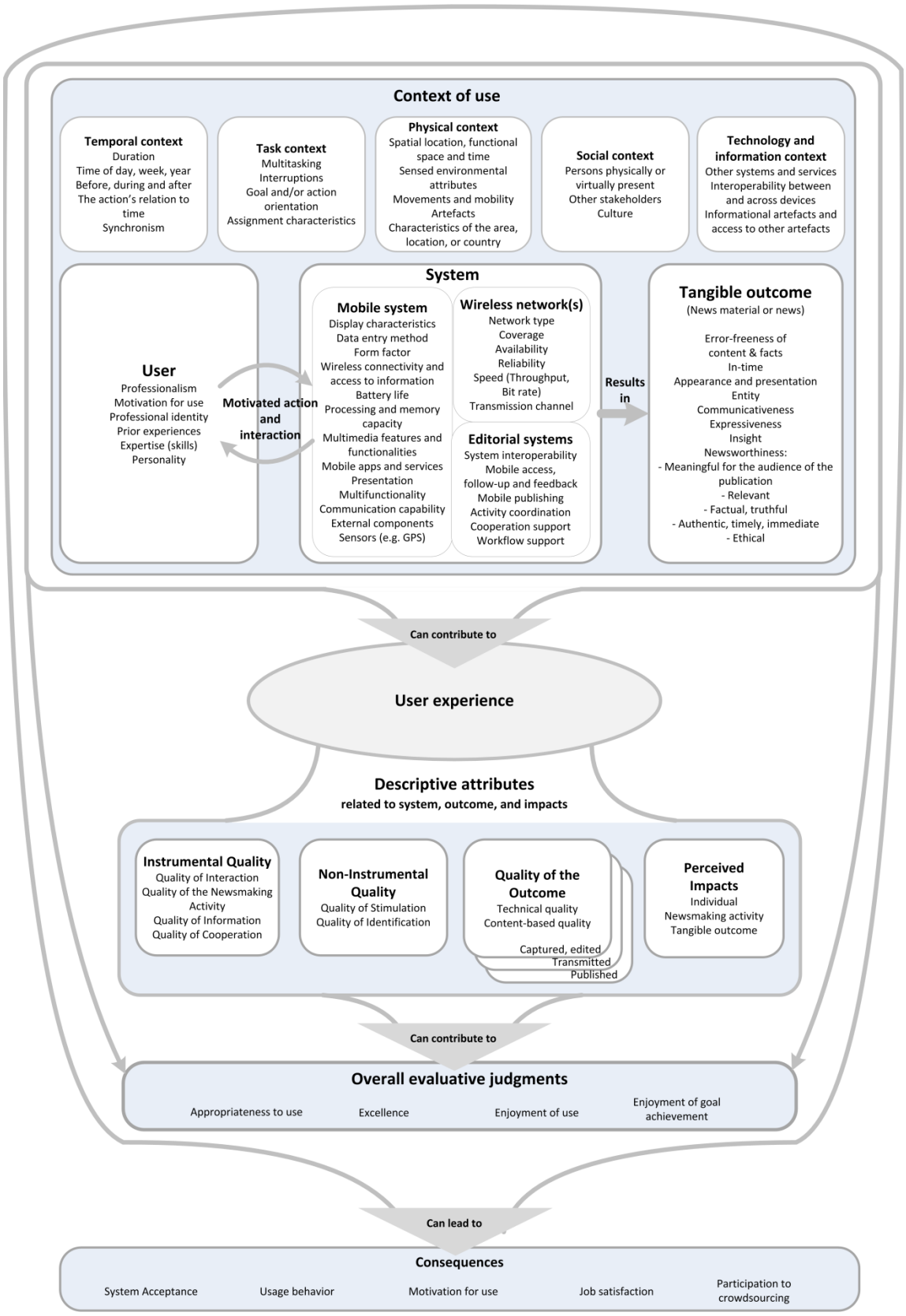

Figure 18. The model of user experience in mobile newsmaking with seven main components: user, system, context of use, tangible outcome, descriptive attributes, overall evaluative judgments and consequences.

6. Discussion and conclusions

The goal of this thesis work was to gain a holistic understanding of user experience in mobile newsmaking with smartphones and to understand how mobile and location-based assignments support cooperative newsmaking in mobile context of use. The thesis summary is composed of synthesized findings from twelve case studies that were published in nine publications included in the thesis. The literature reviews presented in the two theory sections of the thesis summary present the key concepts and definitions, the theoretical background and cover prior research for the issues addressed in the empirical research. They were used in summarizing the findings from the publications, identifying the key contributions and formulating the model of user experience in mobile newsmaking. The case studies had more than one hundred participants of which majority were students of visual journalism with prior work experience in journalism. Two of the twelve studies concentrated on reader participation to newsmaking as a form of crowdsourcing and the rest of the studies concentrated on newsmaking and smartphones as newsmaking tools in professional use. Seven of the studies included the usage of a dedicated mobile service client for newsmaking in the mobile context of use. The research approach was primarily qualitative.

The following subsections are organized as follows. First, the contributions and their implications for theory and practice are discussed based on the main outcomes of the thesis: the model of user experience in mobile newsmaking with smartphones and the process model for mobile assignment-based processes. Second, the assessment of the research is presented. Finally, suggestions for future work are made and conclusions are presented.

6.1 Contributions and implications of the research

This section discusses the contributions and implications of the thesis research for theory and practice. First, the constructed model of user experience for mobile newsmaking with smartphones is discussed in terms of theoretical and practical contributions and implications. This is followed by the practical contributions and implications of the process model for mobile assignments.

6.1.1 The user experience model for mobile newsmaking with smartphones

The model of user experience for mobile newsmaking with smartphones was presented in section 5.3 as an answer to the first research question "What is user experience in mobile newsmaking with smartphones?". **The model is a synthesis of the findings of the thesis work that is guided by the quality-based models of user experience in its construction. It extends and elaborates the reviewed models from HCI that were presented in Chapter 2 based on the findings of this thesis research**. The discussion is presented by outlining first the theoretical and then the related practical contributions and implications.

The constructed model presents a comprehensive overview to user experience in mobile newsmaking with smartphones. It outlines the components of user experience in complex and

creative work that aims at a tangible outcome, in this case, the news material or news. The model can support academics in planning further research in the field of HCI on mobile work by outlining issues to consider for inspection as well as by providing a framework for testing and validation. The model aids practitioners to consider the issues to be addressed in user-centered design of mobile systems. At the same time, user experience provides a theoretical lens to understand mobile newsmaking as an activity carried out in mobile context aiming to publish news rather than merely interaction with a smartphone in the mobile context of use to carry out a set of consecutive tasks.

The model emphasizes the tangible outcome as one of the main components that can contribute to user experience. Jumisko-Pyykkö (2010) describes characteristics of the produced video in case of mobile television contributing to quality of experience, but refers to viewed content as a part of the system. For academics and practitioners the model emphasizes the importance of identifying the characteristics of the produced tangible outcome that can contribute user experience that should be taken into account in user-centered design activities, in research of user experience in work context, as well as in evaluation of system quality. It has the following implications for managers in organizations (e.g. news publishers), who are responsible for ordering or choosing technological solutions, or taking new systems into use and planning related journalistic processes.

The requirements specification, when ordering a dedicated technological solution or system for an organization or when choosing an appropriate solution, could include an explicit description of the goals of the activity and the desired characteristics of the tangible outcome as requirements. The collection of these requirements could be carried out by using user-centered design or participatory design activities. When implementing the take up of new systems in an organization, it can be worthwhile to consider the characteristics of different user groups, and how the system fits to their requirements and goals. This information can be used in agreeing for what type of use, for what situations and by whom the system is used. In addition, in case of news organizations, the processes of handling the materials in the newsroom produced by mobile reporters need to be planned in line with planning and taking new mobile solutions into use to ensure desired quality and outcome.

The constructed model of user experience introduces two subcomponents of descriptive attributes – quality of the outcome and perceived impacts - to the reviewed user experience models in the field of HCI. Quality of the outcome (technical and content-based quality) and perceived impacts (on individual, newsmaking and tangible outcome) complement the two groups of qualities, namely instrumental (pragramatic) quality and non-instrumental (hedonic) quality.

In relation to the quality of outcome, Jumisko-Pyykkö (2011) describes in the model of user-centered quality of experience descriptive attributes for viewing experience and usage in case mobile television. In IS research output quality is defined in technology acceptance model (Venkatesh et al. 2000) and task-technology fit proposed by Goodhue et al. (1995) has output quality as a component of the performance impact. These models support including the quality of the outcome as part of the descriptive attributes.

Practitioners can use the knowledge on user's impressions on outcome quality to identify characteristics of the system that can be critical to be addressed in development in order to ensure the success of the system, and increase the acceptance of the system by the target groups. Verbally

expressed attributes also enable to capture the requirements for the quality of outcome to be fulfilled and to be used in system evaluations.

The perceived impacts (benefits and costs) of system and its use within the activity extend the reviewed user experience models. Impacts are included in the IS success model (DeLone et al. 1992) as a combined construct of net benefits which replaces the separate original constructs of individual and organizational impact. Task-technology fit (Goodhue et al. 1995) refers to the expected consequences of use as an antecedent of utilization as well as performance impacts. The inclusion of perceived impacts of the system therefore seems justifiable also based on the constructs in IS models.

The perceived benefits and costs can contribute to the overall evaluative judgments of the system when considering the appropriateness to use, excellence of the system as well as enjoyment of use and goal achievement. The perceived impacts enable practitioners to create an understanding of critical factors that can lead to the adoption and use of the system. In news industry, understanding the impacts of the system on an individual reporter, newsmaking and news material and news enables the managers and editors in the newsrooms to capture the possibilities, challenges and threats related to the system use as experienced by the employees, and to take action and plan for the future.

The empirical research findings on the context of use describe a comprehensive set of context characteristics that are summarized in the thesis summary. They are used to extend, elaborate and validate the CoU-MHCI model for mobile context of use (Jumisko-Pyykkö et al. 2010). The CoU-MHCI model was used as a framework for description of the characteristics of the context of use that can contribute to the user experience in mobile newsmaking. Results include findings of altogether nineteen subcomponents of the five context components (task, temporal, social, physical, and technology and information context), and extend the CoU-MHCI model with three new subcomponents. The extensions to the subcomponents are the following. Task context was extended with assignment characteristics. Physical context was extended with characteristics of the area, location, or country in relation to safety and privacy issues. Finally, social context was extended by adding stakeholders who are not physically present when interacting with the device but who assess the quality of the news material and reporting, such as customers.

The extended and elaborated model for CoU-MHCI with the described characteristics can be applied by academics and practitioners when developing, evaluating, and studying systems for mobile work. It can be applied to support the development of solutions utilizing location technologies or context-awareness and mobile assignments, for example. Furthermore, it aids in collecting context related information in user studies as well as in identifying typical combinations of the context characteristics for development. Understanding the characteristics of the context of use is especially important as it seems that the circumstances in the context of use can moderate the acceptance level of the qualities, and the overall evaluative judgments. The model supports the management in news organizations to understand characteristics of the context of use that can contribute to user experience. This helps in recognizing how to plan and organize the editorial processes and the division of work tasks and roles between the mobile reporters and the newsroom.

As a summary, the model with its components can aid the academics and practitioners to identify factors that can contribute to user experience or be critical success factors for the system and use

them in development, research and evaluation activities. Furthermore, the managers in organizations gain an understanding of the issues that impact the users' experience. This knowledge can help in choosing suitable solutions, defining requirements for the systems, designing processes and workflows, and aid in the implementation of the system in the organizations to maximize success.

6.1.2 The process model for mobile assignments

The process model for mobile assignment-based processes summarizes the thesis work on cooperative processes for the journalism industry and for solution designers and developers. It illustrates the phases with information and communication needs and requirements related to the process from the point of view of the newsroom and mobile reporter Figure 17 (section 5.2.4). As mobile assignments in the first place implicitly aim for minimizing the communication via other medium, fulfilling the requirements for information are essential.

The process model supports practitioners in the user-centered design of solutions for mobile assignment-based processes and related workflows for news industry. For managers in publishing organizations the model provides support for planning the implementation of mobile assignments in everyday practice of journalistic work. It also provides support for identifying the requirements related to arranging the work and work roles in the newsroom when using mobile assignments. In addition, newsroom staff can get benefit from understanding the requirements of the mobile reporters for the assignment descriptions and related information (see Table 20), as well as for the needs on confirmations and feedback after the material has been received in the newsroom. This information is also useful for the newsroom staff, in case the technological solutions do not provide support and guidance in their implementation for creation of assignment information or for the automatic confirmations and feedback to the mobile reporters.

The findings on mobile assignment-based processes have been disseminated to a news publisher for planning their assignment-based trials and implementations. In addition, results on the context characteristics that can influence participation preferences when using mobile assignments have been applied in further research designs of practical trials with reader reporters in real-life context of hyperlocal news publishing (Väätäjä et al. 2013).

6.2 Assessment of the research

The quality of research is traditionally assessed in terms of reliability and validity. This thesis is based on a naturalistic research paradigm and is interpretive in understanding the phenomenon studied. The research approach was primarily qualitative. Although also alternative approaches have been proposed for assessing the quality of qualitative research, this research uses these two criteria as the primary criteria in the assessment. In addition, credibility and generalizability are discussed.

Reliability deals with the question whether the results of the study are repeatable. This calls for demonstrating that the operations of the study can be repeated. This thesis research addressed reliability in the phase of data collection by using the following tactics for case studies for transparency and replication (see Dubois et al. 2010, Yin, 2003, pp. 33-39). Transparency was addressed by documentation and clarification of the reseach procedures by producing a case study

protocol, which specifies how each case study was conducted. Replication was addressed by creating a case study database, which inclues all the collected and created materials of a study in question in an organized manner to support future use. In addition to the documentation of the research procedures and having an existing database with the data from the case studies, each of the publications and this thesis summary clarify the procedures. Triangulation by using multiple data sources and having several investigators participating in the planning, data collection and analysis phases when possible aimed to increase the reliability.

In qualitative research the researcher him/herself is an instrument in the research. The research design and findings are not value-free but dependent on the values, and background, of the researcher who plans, carries out, analyzes, and interprets the results. The researcher makes numerous decisions in the course of research related to research designs and research questions. These decisions are guided by the interests of the researcher and gaps in research literature, as well as by the constraints of carrying out the research. These decisions influence the research and inferences made from the findings. The interaction between the researcher and the participants of the study, and the presence of the researcher during the usage situations may affect the gathered data and inferences made thereof. Having multiple researchers participating in the research aimed to minimize the impact of one researcher on the research design, data collection, analysis and making of inferences.

Validity is concerned with the consistency of the conclusions from the research. Next, construct validity, internal validity, external validity and ecological validity are addressed for the research carried out for this thesis.

Construct validity deals with the quality of conceptualization or operationalization of the relevant concept, that is, whether correct measures have been used for a concept and an accurate observation of reality is obtained (Dubois et al. 2010, Yin, 2003, pp. 33-39). Yin (2003, pp. 35) proposes two steps: 1) select the specific phenomenon or a portion of it to be studied and relate it to the original objectives of the study, and 2) demonstrate that the measures for the phenomenon or its portion reflect it. This thesis research addressed construct validity by following proposed tactics (Dubois et al. 2010; Eisenhardt 1989; Yin 2003, pp. 33-39): by using multiple sources sources of evidence and different data collection strategies, establishing a chain of evidence from initial research questions to the final conclusions, and adopting different angles to look at the same phenomenon. These were addressed in this research in data collection and composition phases. The **credibility** of the research was addressed as follows. The report and publication drafts were reviewed by experts in the field of journalism, other researchers who had participated in the studies, and external peer reserachers when reviewing the publications. There are multiple holistic realities that are dependent on the individuals and groups that are participants in the case studies. All interventions with smartphone-based systems for professional use were carried out with students of journalism and visual journalism or professionals in complemantary education, which form a group as such within the context of their studies. These participant related issues may cause bias in the results as well as affect the generalizability of the results. By using multiple single case studies in the thesis research, the influence of participants from one study was aimed to be reduced.

Internal validity refers to establishing a causal relationship between conditions. This thesis research is primarily exploratory, and it does not aim to create or prove causal relationships between variables or conditions. However, internal validity was addressed also in this research based on the recommendations for case study research to be able to make inferences (Dubois et al. 2010, Yin 2003, pp. 33-39). The thesis research created and used in the research design stage a formulated research framework as suggested. In case of user experience an initial conceptual framework (see Figure 15) was created for user experience based on prior literature, which was refined throughout the research based on the findings. For mobile and location-based assignments a framework for studying the participation preferences was similarly created based on prior research on privacy issues (see Table 19). Pattern matching was used to compare the findings on the characteristics of context of use to a prior model. Theory triangulation was done by visiting theories and models, also from other disciplines, to adopt multiple viewpoints to the findings in data analysis phase. In addition, rival explanations were addressed as discussed in the end of this section in limitations.

External validity is concerned with the generalizability of the results beyond the specific context studied in the research. Instead of statistical generalization, qualitative case studies allow for analytical generalization from the empirical observations to theory (Dubois et al. 2010; Eisenhardt 1989; Yin 2003, p. 37). This thesis research addressed external validity with a multiple case study approach and used not only single case study approach but also cross-case analysis of the cases (Eisenhardt, 1989). The rationale for the choices for the cases and their context were described (Cook et al. 1979, as cited in Dubois et al. 2010).

Ecological validity is a criterion concerning whether the reseach findings, i.e., what is observed and recorded, are applicable to natural settings. It also deals with **generalizability** from the point of view of generalizing to the real world. Most of the studies of this thesis were carried out in the field and all of the studies dealt with participants' real life experiences in a natural context of use. Therefore, the studies provided rich, in-depth data from real life experiences and use of smartphones for newsmaking in mobile context of use. The findings and models presented can be applicable in other fields of mobile work that are complex, include collection of material and may be creative by nature, such as in the fields of anthropology, sociology, ethnography, art or architecture – or even for HCI researchers and practitioners themselves who are using mobile devices, such as smartphones, as data collection tools. In addition, the mobile assignment-based process model can be applicable to also mobile fieldwork such as maintenance and home care in addition to mobile crowdsourcing that is essentially one form of mobile work.

Generalizability from this research is also related to the following issues. In the studies of the thesis, all interventions with smartphone-based systems for professional use were carried out with students of journalism and visual journalism, and most of these studies were carried out in the context of their studies. Although most of the participants in the intervention studies were students, majority of them had practical work experience in the field of journalism. The case studies are bound to the location and time of carrying out the studies, which can limit the generalizability of the findings. When technology is studied in real-life practice the results are influenced by the maturity of the technology, the phase of adoption, and changes caused by the technology in the practices of

newsmaking at that particular point of time. The low number of participants in the single case studies limits the generalizability from a single case study, but is tackled by the multiple case studies of this research. In addition, the findings from the studies started to saturate as the number of studies grew.

Generalizations from the studies can be made on the level of components and their parts in the user experience model as well as on the cooperative aspects in mobile assignment-based processes. The components and their parts in the constructed models presented in this thesis can be applicable when developing research designs in other fields of mobile work, as well as when planning system evaluations. Validation of the presented models can be carried out in further research.

6.3 Suggestions for future work

The findings of this thesis suggest the following directions for future research. The focus of the presented suggestions is the outcome of usage that deserves more attention.

This research highlights the importance of the tangible outcome (news material, news) of using the system within the activity in organizational context as an important component that can contribute to user experience. Future studies on user experience could take this aspect into closer inspection from several viewpoints: the characteristics of the outcome as requirements for the system, understanding different types of outcomes and their characteristics and connection to user experience and experienced system quality, and the connection of experienced quality of the tangible outcome to overall evaluative judgments and consequences, for example.

As published news is public by nature, the quality of the outcome is evaluated not only by the mobile reporter but also by other stakeholders, such as colleagues, editors, customers, other professionals in other news organizations, other reader reporters, and the audience (i.e., the readers). In the studies of this thesis this theme came up several times, and the participants seemed to consider this aspect when evaluating the quality of the system themselves. It would be interesting to study both the requirements for the quality of the outcome in more detail from different perspectives, as well as the experienced quality of the outcome by different stakeholders and how it is described to understand the similarities and differences. In addition, as the activity of newsmaking is considered creative, the relation of the tool to user experience in this type of activity and how to design for creative activity deserves more attention.

6.4 Conclusions

To conclude, user experience in mobile newsmaking is constructed in a process of using the mobile system in a goal-oriented and creative activity in the mobile context of use. User experience is a consequence of motivated action and interaction with the smartphone within the mobile newsmaking activity that has goals specified by the user, organization, and other stakeholders, such as a customer, and by the circumstances within which the activity takes place. The experiential components of user experience include the user's verbally expressible impressions in the form of descriptive attributes that are related to the system, the tangible outcome of system use, the impacts of the system, and overall evaluative judgments. The characteristics of the user, system, the context

of use and tangible outcome can contribute to user experience. The thesis work emphasizes that the characteristics of the tangible outcome (news material, news) can contribute to user experience.

To create systems and solutions and evaluate them for mobile reporters, whether professionals, readers or crowdworkers, and their cooperation with newsrooms, an understanding of user experience and what contributes to it is needed. The constructed model of user experience in mobile newsmaking with smartphones and the process model for mobile assignment-based processes summarize the outcomes of the thesis work. The presented models and the related empirical results can aid academics and practioners in developing, studying and evaluating systems for mobile work. In addition, managers in news organizations can apply the outcomes of the thesis work in planning and carrying out operations and implementations related to technology, processes and workflows to support mobile newsmaking.

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Appendices

Appendix 1: Candidate's contribution to the publications

The contribution of the candidate (Väätäjä) is marked in the following Table 21 (applying Devine et al. 2005). Level of candidate's participation is indicated as high (2) or low (1). N/A indicates "not applicable".

Table 21. Candidate's contribution to the publications of the thesis with indication of the level of participation.

Contributorship item for byline = authorship	P1	P2	P3	P4	P5	P6	P7	P8	P9
1 Conceiving the idea for the project or study	2	2	2	2	2	2	2	2	2
2 Conducting literature searches	2	2	2	2	2	2	2	2	2
3 Participating in study design	2	2	2	2	2	2	2	2	2
4 Developing & refining study design	2	2	2	2	2	2	2	2	2
5 Designing the database	2	2	2	2	2	2	2	2	2
6 Collecting data	2	2	2	2	2	2	2	1	1
7a Developing analyses plans	2	2	2	2	2	2	2	2	2
7b Analysis of data	2	2	2	2	2	2	2	2	2
8 Writing first draft of paper	2	2	2	2	2	2	2	2	2
9 Reviewing & commenting on first draft	N/A	2	2	N/A	2	N/A	2	2	2
10 Revising first draf & finalizing publication	2	2	2	2	2	2	2	2	2
11 Coordinating & managing project operations & progress	2	2	2	2	2	2	2	2	2
12 Responding to peer reviewer comments	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	N/A
13 Answering letters to the editor or similar	2	2	2	2	2	2	2	2	2

Appendix 2: Factors of newsworthiness

Table 22 is organized based on the original twelve factors, which Galtung and Ruge (1965) identified as determining how events become news, i.e., how journalists have judged the newsworthiness of an event. These twelve factors were identified in a study on how overseas events become foreign news in the Norwegian press. The list is complemented with a study by Harcup and O'Neill (2001) in which they test the taxonomy by Galtung and Ruge in an empirical analysis of three national daily UK newspapers. Harcup and O'Neill present ten factors for newsworthiness, of which eight overlap the original factors presented by Galtung and Ruge (1965). Finally, ten further news qualities that are used to determine newsworthiness are listed in Table 22.

Table 22. Categorized factors of newsworthiness. Original factors identified by Galtung and Ruge (1965) are in bold in column "Factor".

No.	*Category*	*Factor*	*Description*	*Source*
1	Timing	**Frequency** or time span	An event that unfolds at the same time as, or at similar frequency to, the news medium is more likely to be selected than a social trend.	Galtung & Ruge (1965) Sissons (2006)
		Timing	News arriving just before a deadline is more likely to be reported than news arriving right after the deadline.	Smith (2007)
2	Scale	**Threshold** (Significance)	Events that pass a threshold like great intensity, the gruesomeness of a murder, the number of casualties. The relative importance of a story; the size of the effect on the audience.	Galtung & Ruge (1965) Sissons, 2006
		Magnitude	Stories that are perceived as sufficiently significant ether in the numbers of people involved or in potential impact.	Harcup & O'Neill (2001)
		Consequence and impact	The effect of the story on readers.	Itule & Anderson (2007)
		Scale	The more people involved, the greater the impact.	Smith (2007)
3	Unambiguity	**Unambiguity** (clarity)	The less ambiguous, the more easily understood and the clearer the meaning of the event is, the more likely the event is to become news.	Galtung & Ruge (1965) Sissons (2006)
		Simplicity	Easily understood.	Smith (2007)
4	Relevance	**Meaningfulness** (closeness to home)	The culturally similar and pertinence to the culture of the society in which news is reported (as its meaning is then more easily understood).	Galtung & Ruge (1965) Sissons (2006)
		Relevance	Stories about issues, groups, and nations that are perceived to be relevant to the audience.	Harcup & O'Neill (2001)
		Proximity	Relevance to local readers (events are close to home)	Itule & Anderson (2007)
		Relevance	The closer the audience feels to the story, e.g., their geographical or cultural proximity. Dependent on the audience in question.	Smith (2007)
5	Predictability	**Consonance** or predictability	A predicted or anticipated event.	Galtung & Ruge (1965) Sissons, 2006
6	Unexpected-ness	**Unexpectedness** (unexpected or rare)	The most unexpected or rare event.	Galtung & Ruge (1965) Sissons (2006)
		Surprise	Stories that have an element of surprise and/or contrast.	Harcup & O'Neill (2001)
7	Follow-up	**Continuity**	Once an event has become headline news it remains in the media spotlight for some time.	Galtung & Ruge (1965) Sissons (2006)
		Follow-up	Stories about subjects already in the news.	Harcup & O'Neil (2001)
8	Composition and news agenda	**Composition**	It fits into the overall composition or balance of a newspaper or news broadcast	Galtung & Ruge (1965) Sissons (2006)
		Newspaper's agenda	Stories that set or fit the news organization's own agenda.	Harcup & O'Neill (2001)
9	Influential nations	**Reference to elite nations**	The actions of certain states are seen as more consequential than the actions of other nations	Galtung & Ruge (1965) Sissons (2006)
10	Eminence and prominence	**Reference to elite people**	The actions of elite people (usually famous) are more consequential and also readers may identify with them.	Galtung & Ruge (1965) Sissons (2006)

		The power elite	Stories concerning powerful individuals, organizations or institutions.	Harcup & O'Neill (2001)
		Celebrity	Stories concerning people who are already famous	Harcup & O'Neill (2001)
		Eminence and prominence	Noteworthy people are involved.	Itule & Anderson (2007)
11	Human interest	**Reference to persons** (Person-centered)	News has a tendency to present events as the actions of named people rather than as a result of social forces.	Galtung & Ruge (1965) Sissons (2006)
		Human interest	The audience likes to hear stories about interesting people.	Itule & Anderson (2007)
12	Negativity	**Reference to something negative** (Negativity)	Unambiguous and consensual, more likely to be unexpected and to occur over a shorter period of time than positive news. "If it bleeds, it leads".	Galtung & Ruge (1965) Sissons (2006)
		Bad news	Stories with particularly negative overtones, such as conflict or tragedy.	Harcup & O'Neill (2001)
13	Drama	Conflict	Big or small scale conflict, that is developing/resolved and has meaning or impact for someone (people, officials, groups).	Itule & Anderson (2007)
		Drama	Eyewitness accounts of dramatic action.	Smith (2007)
14	Entertainment	Entertainment	Stories concerning sex, show business, human interest, animals, an unfolding drama, or offering opportunities for humorous treatment, entertainment, photos, or witty headlines.	Harcup & O'Neill (2001)
15	Good news	Good news	Stories with particularly positive overtones such as rescues and cures.	Harcup & O'Neill (2001)
16	Timeliness	Timeliness	Recent, fresh events.	Itule & Anderson (2007)
17	Novelty	New to audience	Tells something the audience does not know; recent.	Smith (2007)
18	Availability	Availability	Reported and covered.	Smith (2007)
19	Exclusivity	Exclusivity	Scoops – stories that set the agenda for rival publishers or broadcasters.	Smith (2007)
20	Trendiness	Trendiness	Trendy topics that set the news agenda.	Smith (2007)
21	Acceptability	Acceptability	Legally safe, ethically sound; conforms to what the news publisher is ready to print and the audience to read.	Smith (2007)
22	Illustrations	Pictures	Stories with illustrations (audio, photo, video footage) preferred.	Smith (2007)

Appendix 3: The characteristics of the mobile systems used in the studies of the thesis

Table 23. The mobile technology provided for use in the studies (adapted and extended from P6 and P7).

Study	*Phone model*	*Display size*	*Keyboard used in the study*	*Max. Photo Res.*	*Max Video Res.*	*Mobile service client prototype*	*Main functionalities of the mobile service client*	*Status of the mobile client prototype*
1	Nokia N82	2.4", color QVGA, 240x320 px	Numeric keypad, external Bluetooth keyboard Nokia SU-8W	5 MP	VGA, 30 fps	Mobile Journalist Toolkit client	1. Write a story (title, free text) 2. Add media files: photo(s), video(s), audio clip(s) 3. Add metadata 4. Upload story (direct online publishing or as a draft for editors)	Functional
3	Nokia N82	2.4", color QVGA, 240x320 px	Numeric keypad	5 MP	VGA, 30 fps	FTP based client of news organization	Upload photo(s) and video clip(s) to newsroom server	MCC (Mobile Co-Creation client) prototype not functional, used FTP solution functional
4	Nokia N82	2.4", color QVGA, 240x320 px	Numeric keypad, external Bluetooth keyboard Nokia SU-8W	5 MP	VGA, 30 fps	MCC (Mobile Co-Creation) client, prerelease 1	1. Mobile assignments (receive, accept, reject) 2. Create a story (answer assignment, or create new) 3. Add media files (audio, photo, video) 4. Submit a story (direct online publishing, or as a draft)	Functional
7	Nokia N97 & N900	3.5" color TFT LCD, resistive N97: 640x360 px N900: 800x480 px	QWERTY keyboard	5 MP	VGA, 30 fps/ WVGA, 25 fps	MCC client, prerelease 2	As in study 4	Prototype not functional during the study
8	Nokia N900	3.5" color TFT LCD, resistive N900: 800x480 px	QWERTY keyboard	5 MP	WVGA, 25 fps	MCC client, prerelease 2	As in study 4	Functional
9	Nokia N97 & Nokia N900	As in study 7	QWERTY keyboard	5 MP	As in study 7	MCC client, prerelease 3	As in study 4	Partly functional, usability issues
10	Nokia N900	3.5" color TFT LCD, resistive N900: 800x480 px	QWERTY keyboard	5 MP	WVGA, 25 fps	Need4Feed client, prerelease 1	As in study 4	Functional
12	HTC Legend	3.2" color AMOLED, capacitive 320x480 px	Software (onscreen) QWERTY keyboard	5 MP	VGA, 30 fps (QVGA used in the study)	OKReport-teri v.2.1	1. Capture, browse, and delete photo and video content 2. The possibility to choose between precise (GPS based) or approximate (cellular) geotagging of photo and video content 3. Upload of captured media file	Functional

Appendix 4: Contextual data collection in the field

Table 24. Examples of data to be captured about the context of use during observations.

Dimension	*Examples of data captured about the context of use in field notes*
Temporal	Date of the observation session Time of starting and ending an observation Time of the reporter arriving to or leaving a location or place Time of the reporter starting and ending an interview or other encounter (e.g., photographing) with externals Time of the reporter starting and ending a transition between places Deadline for the reporting; the available time for reporting Times of starting and ending different phases of reporting Pace of reporting, using or interacting with technology (in a hurry, etc.)
Physical	Location, place (fixed, moving) Lighting (especially when the reporter captures photos and video clips) Temperature (outside, especially in winter time) Other ambient weather conditions (rain, snow, etc.) Ambient noise (especially when reporter captures video clips) The furniture used by the participants Artifacts used in newsmaking (such as notebooks) The mobility, position, and movement of the user and/or smartphone in the environment Usage positions of the mobile technology
Social	Crowdedness (when using mobile technology for reporting) Collaboration with others in reporting Persons present when using mobile technology The person being reported on (interviewed, photographed) The event of reporting (general descriptive information) Communication (and its content) with externals, persons present, colleagues Professional culture
Technology and information	The used mobile technology (including smartphones and, e.g., navigators, laptops, cameras) The used mobile applications or services on the smartphone (including enabled communication and information access) The other infrastructure available (network connections, other IT systems, IT processes)
Task	Goals Primary, secondary, and parallel tasks Multi-tasking Interruptions

Appendix 5: Privacy concern related results related to P9

Privacy concern score was calculated in P9 based on an average (sum divided by number of items) of five used items from IUIPC (Internet User's Information Privacy Concerns) scale (Malhotra et al., 2004, Tsai et al, 2009, see P9 for items). Results are the following:

Privacy concern score: min = 5, max = 7, Md = 6.5, M = 6.39, SD = .58. Scale for averaged items: 1 = minimum, 7 = maximum.

The perceived risk versus benefit of sharing the precise location with the newsroom (Tsai et al. 2009) was assessed with the item: "*Giving permission to the newsroom to locate my mobile phone precisely is…"* Scale: 1 = "Much more risky than beneficial", 7 = "Much more beneficial than risky". Results: min = 2, max = 7, Md = 5, M = 4.74, SD = 1.33

Risk belief was adopted from the IUIPC scale by Malhotra et al. 2004: "*In general, it would be risky to give the newsroom a permission to locate the mobile phone."*.

Nonparametric correlation (bivariate with Kendall's tau, 2-tailed) was calculated between preciseness of locating and 1) Privacy concern score, 2) Risk belief and 3) Perceived Risk vs. Benefit of sharing the precise location with the newsroom. Of the calculated correlations, only the last one, the perceived risk or benefit of sharing the precise location with the newsroom, correlated on a statistically significant level with preciseness of locating (Item: "*Giving permission to the newsroom to locate my mobile phone precisely is…", Scale: 1="Much more risky than beneficial", 7="Much more beneficial than risky"*): precise ($\tau = .433$, $p < 0.05$) and approximate locating ($\tau = .427$, $p < 0.05$). Other nonparametric correlations were statistically non-significant.

Original publications

Paper 1

Väätäjä, H. 2010. User experience evaluation criteria for mobile news making technology: findings from a case study. *Proceedings of the 22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction* (OZCHI '10). © 2010 ACM, New York, NY, USA. pp. 152-159. http://doi.acm.org/10.1145/1952222.1952252

User Experience Evaluation Criteria for Mobile News Making Technology – Findings from a Case Study

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ABSTRACT
This research explores the professionals' user experience evaluation criteria for technology used in mobile news making. We carried out a case study in which nineteen participants used smart phones for reporting news to an online publication. We identified two sets of high-level evaluation criteria, contextual and personal. Contextual high-level criteria found are error-freeness, support for journalistic quality and speed of publishing. Personal, user-related criteria are users' needs and goals related to enabling and supporting of professional ambition, supporting user's professional goals, as well as fit with and enhancement of the user's professional image. Findings provide empirical evidence on factors that affect user experience that are relevant for evaluation of mobile technology in mobile news making. In addition, findings provide an initial insight into understanding professionals' user experience and importance of high-level goals and needs as factors linked to quality perceptions, attitudes, acceptance, affect and motivation to use mobile technologies in work context.

Author Keywords
User experience, mobile phone, news, journalism, work.

ACM Classification Keywords
H.1.2 [**User/Machine Systems**]: Human factors.

INTRODUCTION
Smart phones with multimedia capabilities provide both technical and functional capabilities, which enable capturing of news content, creating news stories as well as delivering and publishing news directly from the field. Therefore, a smart phone is a potential all-round tool for professionals in mobile news making (Jokela et al. 2009). However, using mobile multimedia phones in news journalism poses questions not only to the suitability of the devices on the functional level. A wider set of factors are likely to affect the user experience in professional use and therefore the acceptance, adoption and motivation to use smart phones as tools in mobile news making.

User experience is often defined as a consequence of the interaction between a user and a product, system or service. It is affected by the characteristics of the user and the product as well as the contextual factors (Desmet et al. 2007; Forlizzi et al. 2000; Hassenzahl 2003; Hassenzahl et al. 2006). Furthermore, several proposed frameworks for user experience suggest that user experience, that is, the subjective perception of product character or qualities (Hassenzahl, 2003; Mahlke et al. 2007) as well as emotional responses (Mahlke et al., 2007), affects the future usage behavior (Hassenzahl, 2003; Mahlke et al. 2007) and overall judgment, preference and satisfaction (Hartmann et al. 2008; Hassenzahl, 2003; Mahlke et al. 2007). In mobile news journalism, also infrastructure, such as mobile connectivity (see e.g. Zhang et al. 2005) and the final outcome, the published news item in a publication, affect the user experience as illustrated in Figure 1.

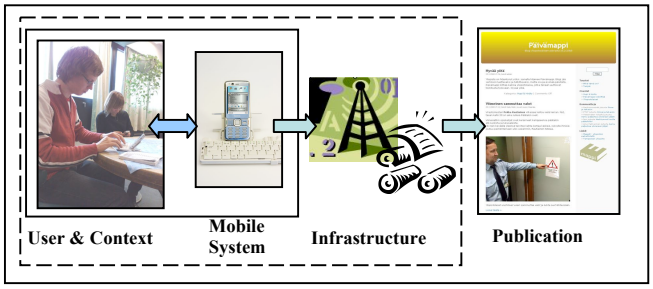

Figure 1. Main elements related to user experience.

Although user experience has gained increasing attention in the HCI (Human-Computer Interaction) community in the last decade, little empirical research exists on the user experience of professionals using mobile phones and services in their field work. According to Brandtzæk et al. (2003), a series of well-defined tasks for achieving well-defined goals is not enough to satisfy the user. In a recent study on positive experiences with technology Hassenzahl et al. (2010) found that the fulfillment of universal needs was related to positive affect, product perception and evaluation. Therefore, we need more knowledge on what contributes to user experience when smart phones are used in mobile work and what criteria users use in their subjective evaluations of the technology in their context.

Our research aims to provide insights into the user experience and evaluation criteria which users use – consciously or unconsciously – in their quality perceptions and judgments. The results are grounded on empirical evidence from a case study on mobile news making. Findings provide new knowledge on user experience of work related technology and on factors which may affect user's attitudes, acceptance and

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motivation to use mobile technology for mobile field work. Findings can be used as potential themes in preparing further studies and evaluation of mobile technology as well as to guide the development of mobile systems for mobile work.

In this paper, we report our findings from a case study on contextual and personal high-level goals and needs that are used as evaluation criteria by users when a smart phone is used for mobile news making. Nineteen master's level students of journalism, who all had practical work experience, used a mobile journalism system prototype for reporting news on university life to an online publication on two project days. We used observations, semi-structured interviews and questionnaires to gather information related to the user experience before, during and after the usage of the mobile system. In the following section, we review related work. We then describe the research methods and setting of the study, followed by the results. We conclude with a discussion of the results in relation to literature, limitations of the study and proposals for future work.

RELATED WORK

Harbich et al. (2008) present one of the few discussions on the relationship between user experience and work environment. Based on the work by Ryan and Deci (Ryan et al. 2000) on extrinsic and intrinsic motivation and self-determination theory, Harbich et al. propose that intrinsic motivation, which they note to be closely related to attributes that Hassenzahl (2003) calls hedonic qualities, enhances well-being, job satisfaction and performance. Likewise, Norros et al. (2008) discuss that experience of technology use is related to job satisfaction and high motivation. Few empirical studies report on assessment of for example hedonic quality perceptions or attractiveness of work related technology (see e.g. Isleifsdottir et al. 2008; Schrepp et al. 2006). Investigations into understanding the users' high-level goals and needs behind the perceptions and evaluations, which are grounded in empirical data of professionals' experience, are lacking.

Several researchers studying user experience in experimental settings have recently drawn attention to how context, motivational orientation or goals affect the quality perceptions, appeal and overall judgments of interactive technology (e.g Hartmann et al. 2008; Hassenzahl et al. 2008). Hassenzahl et al. (2008) studied the effect of regulatory focus (being either in prevention or promotion focus) on the evaluation of the product and choice. The activated regulatory focus affects the product appeal and choice, supporting strong context-dependency. Similarly to findings by Hassenzahl et al. (2008), Hartmann et al. (2008) report, that quality assessment is context dependent. According to their study, user judgments on studied quality attributes are affected by framing effects of the task and the users' background. Therefore, in their framework for user judgment on quality attributes, Hartmann et al. (2008) propose, that user's goals, task and user's background influence the selection of the decision making criteria used in the subjective evaluation of experience. Furthermore, Hassenzahl et al. (2010) report that the fulfillment of universal psychological needs, such as relatedness, stimulation and competence, is related to hedonic quality perceptions, positive affect and product evaluation (goodness) when participants were asked to report positive experiences with technology.

In another line of work on emotional design, but related to user experience, Demir et al. (2009) use appraisal theory as a basis to identify and specify appraisal components that elicit specific emotions in product users. One of the seven studied appraisal components is the motivation consistency component, that is, the consistency or inconsistency with what one wants. Demir et al. report that in their study, this is the most central appraisal component. Three levels of motives are identified. The highest level motives are general motives - universal goals and needs. In the middle level are contextualized motives, which are situation-dependent specifications of the general motives. The lowest level, interaction goals, is related to the operation or maintenance of products. In relation to users' evaluation of product qualities and overall judgments, these motive levels together with elicited emotions are potential candidates for identifying issues and criteria behind subjective evaluations.

Technology acceptance research has been extensive in past decades. One of the most cited models is Technology Acceptance Model (TAM) presented by Davis et al. (1989), with numerous extensions (see e.g. Venkatesh et al. 2003; Yi et al. 2006). The basic concept underlying user acceptance models is that individual reactions to using information technology affect the intentions and actual use of information technology. Venkatesh et al. (2003) synthesize eight acceptance models which employ intention and/or usage as the dependent variable. They report three direct determinants of intention – performance expectancy, effort expectancy and social influence – and two direct determinants of usage behavior – intention and facilitating conditions. Although constructs related to attitude, intrinsic motivation and compatibility from their initial research model were not included in the unified model (UTAUT, Unified Theory of Acceptance and Use of Technology), these themes are worth exploring in further empirical work and are clearly linked to user experience research in work context.

To summarize the reviewed literature, user experience in work settings is potentially related to for example intrinsic motivation, goals, needs, job satisfaction, intention to use, affect and acceptance of technology. Our research contributes to the studies on user experience in work settings by providing results from the specific context of news journalism. We present evaluation criteria related to high-level goals present in news journalism as well as more personal user-related criteria.

METHODS AND SETTING

We used case study approach (Yin, 2003) in this study. Our goal was to gain a deeper understanding of the user experience – how participants experience the smart phones in this context and further, what criteria they use

beyond task accomplishment in their assessment of the mobile technology in mobile news making.

Participants

There were nineteen participants in the study (12 female, 7 male), ages between 22 and 41. Participants were M.A. level students of journalism and visual journalism in a university, who took part in a project course on web publishing. All participants had practical working experience in the field of journalism (min=1yr, max=18yrs, mean=3.5yrs). Working experience had been gained as freelancer work or as employees or trainees in newspaper organizations or in radio. All participants used in their daily life their own mobile phone for phone calls and text messaging. Ten of the participants were studying journalism (called journalists from now on) and nine were studying visual journalism (called photographers from now on). The photographers had prior experience in using a mobile phone within their studies, whereas journalists had no similar experience. Participants received practical, hands-on training to use the mobile journalism system for mobile publishing in the beginning of the study. They were offered a small compensation for taking part in the interviews in form of a ticket voucher to a movie.

Mobile journalism system

Participants used a multipart mobile journalism system consisting of a smart phone (Nokia N82), a foldable, wireless Bluetooth keyboard (Nokia SU-8W) and a prototype of a mobile journalism software application. Nokia N82 is a smart phone with a 5 megapixel camera for capturing stills and video, equipped with a Xenon flash and a voice recorder. It provides a wireless broadband connection via WLAN and mobile 3G cellular connection. The mobile journalism application provides functions for creating news articles by enabling typing of text (stories), attaching a combination of multimedia files including stills, video and audio clips and creating metadata for the article (Jokela et al. 2009). Furthermore, it supports the mobile delivery of the news material to the editorial system.

Setting of the study

The study was conducted in a university course setting due to the phase of the application development. This was the first trial where stories were even published directly from the field to a web publication with the mobile system. The participants used the mobile journalism system for reporting the university life directly from the field to an online publication during two project days. Some of the news stories were made as a series of short entries with stills, some as longer articles with text, stills and video clips (see e.g. Jokela et al. .

Data collection and analysis

The main sources of data analyzed for this paper are notes from participant observations and transcriptions of recorded semi-structured interviews. A protocol was made for taking the field notes. Observers minimized the disturbance to the work of the participants for example in interview or photographing situations by keeping distance. Conceptual frameworks on user experience (e.g. Forlizzi et al. 2000; Hassenzahl, 2003), were used as background theories in planning the themes for semi-structured interviews. In addition, pre- and post-usage questionnaires were used to collect information for example on participants' background, attitudes, expectations and quality perceptions. The results from the questionnaires are not in the focus of this paper and therefore not discussed here further.

Pre-usage interviews were conducted as two group interviews, separately for two photographers and three journalists. Pre-usage interviews covered themes for example on attitudes and expectations on using smart phones for news journalism. Altogether 85 hours of participant observations were made by members of the research team. Observations covered the planning and training sessions a week before the project days, participants working and using the mobile journalism system on the project days in natural context and the wrap-up session a week after the project days. No tasks were given by researchers to the participants. Eleven participants were interviewed after the first project day and four after the second. Interviews lasted from about an hour to an hour and a half.

The transcribed data from the interviews and observations was analyzed by content analysis (Miles et al. 1994). We gave descriptive labels to notes using inductive reasoning and formed groups out of them. High-level categories were formed out of the emerging groups. Finally, we searched for explanations in our data to create an understanding of why these categories had emerged in relation to the context of news journalism.

RESULTS

Two main categories of high-level evaluation criteria emerged in the analysis. First category includes themes on contextual high-level goals in news journalism. Second category consists of personal goal and need related themes that participants used as subjective criteria in their assessment of the system.

Contextual high-level criteria

In the observations and interviews, participants expressed that important issues in news journalism are that 1) articles and the publication are error-free, 2) deadlines are respected, i.e. that news articles or news items are created and published according to the agreed and given deadlines, 3) in online publishing, when unexpected news events are reported, the speed of publishing is important, and 4) journalistic quality requirements are met. These four expressed criteria can be categorized into three groups - error-freeness, journalistic quality and speed. Participants used these criteria in their assessment of the mobile journalism system. In the following, we discuss the findings in relation to these criteria.

Error-freeness

Error-freeness is the surface level criteria for the quality of a news item. It refers to the facts of the articles, to spelling and to the technical quality of the published multimedia (photos and video clips). Some interviewees stated that it is embarrassing for them as professionals, if

their article or the publication has errors, for example, in the names of the interviewees. In addition, spelling mistakes were mentioned to give an impression of lower quality of the publication and leading to lowering of the respect by the audience. A journalist criticized that using a certain device would forgive errors:

"The reader cannot know that an article is written with a mobile system and does not forgive spelling mistakes." Journalist 13

According to the participants, the most influential components of the mobile system to affect the error-freeness of the text are 1) the keypad or keyboard used for text entry, 2) the size of the screen (in this case 2.4 inch) in viewing and editing and 3) a spell checker and/or predictive text entry when writing or checking the text.

In case of video clips the importance of correct audio-video synchronization was highlighted, which was seen as an unacceptable problem with video clips captured with Nokia N82. In addition, experienced and mentioned problems due to mobile delivery that lowered the quality of the delivered and published video clips were 1) blocking artifacts, 2) missing frames or 3) only part of the video being delivered and published.

Support for journalistic quality

Whereas error-freeness was described as the criteria for the surface level quality of news, journalistic quality refers to a more profound, deeper level quality. Participants mentioned that issues related to the journalistic quality are, for example, the meaningfulness of the publication's content to the target group, relevancy of the news, the contentual quality of material (text, photos and video clips and the entire article), visual appearance of the story and publication (layout), factuality and the ethical issues involved in the publishing. We concentrate here primarily on the quality of the material and layout, since they are closely related to the technology being used. In addition, we found that the acceptance of quality is affected by the situation at hand. Furthermore, relevancy is related to smart phones in news creation since they enable fast creation and delivery of relevant and timely news material.

Participants explained that in news journalism the entity of the story consisting of text, photos and video clips is important. They further described that good photos and videos tell a story of their own, supporting the story and showing something the text does not reveal. An essential part of a visual or multimedia publication is its appearance referring here to layout in addition to the visual quality of the multimedia material. Due to this, when directly publishing to web publication from the field, the participants expressed a need for editing the layout with the mobile application.

The quality of the multimedia material is highly dependent on the technical capabilities or limitations of the used technology in multimedia capture and editing. In general, participants did not find the quality of the photos to be acceptable neither for print nor for online publications, other than social media services, blogs or similar due to quality of optics, resolution and missing adjustments (focus, lighting). However, participants were positive towards using a smart phone for video capture especially in case of online news videos, since often neither journalists nor photographers have dedicated video cameras along or in their usage.

The perceptions on the suitability of photos and videos taken with mobile phone were relative to the situation at hand and to what media the material is intended for. For example in case of ad-hoc, fast, reporting situations, the roughness and authenticity of the multimedia material was expressed to be understandable and even wished for. Therefore in the case of for example accident or catastrophe reporting the lower quality of the material, even photos, was seen acceptable, if it was published immediately. One of the photographers described the relationship between speed and quality as follows:

"[Using] the device forgives, the material does not need to be so polished. You can never be both fast and finalized." Photographer 12

On the contrary to the expressed effect of used technology for multimedia quality, participants described that the text and the story are less dependent on the technical capabilities, being more dependent on the skill of the journalist. One of the journalists expressed this:

"If I was on a work trip in a bush, the reader would not know, that it had been done with that [mobile journalism system], after all. Text is so different [compared to photos and videos] – the [contentual] quality of the text depends on your thinking, and not on the device." Journalist 9

However, the small size of the smart phone display was mentioned as a major limitation in writing: it caused problems in visualizing the article when writing, editing and finalizing the article. Due to the small screen (2.4 inch), even when using the external QWERTY keyboard, participants found the current system most suitable for writing short texts, such as newsflashes, from a few hundred to a maximum of 1000 characters. In addition, journalists wished for more advanced editing functionalities.

Speed

The work in news journalism is time-critical through the deadlines and need for fast and timely publishing. In journalism deadlines are set by the organization to manage the editorial work in the newsroom. The newspaper needs to be in print on time or the broadcast in the air. However, in online news publishing the "*deadline is now*", especially when reporting unexpected newsworthy events. A development manager for a local newspaper's online version described in a seminar on mobile journalism this as follows: the first one to report the news, with authentic and exclusive multimedia material, is more likely to get the most "clicks" to the online publication and therefore most visibility.

According to the participants, one of the most important strengths of using smart phones for news reporting is the enabling of the mobile delivery directly from the spot of the news event. To support this as well as the fast and

timely news delivery and publishing, reliability and performance of the network connectivity and throughput of the system were found to be critical success factors.

Based on our study, the most promising identified use for a smart phone in news reporting is video capture. This poses requirements for the throughput and data rate in mobile delivery and related latencies. Video clips are relatively large in size when captured with acceptable quality for news reporting. For example a one minute video clip captured with N82 is about 20 MB with best "TV" quality (VGA, 30 fps, MP4). In optimal case it is delivered in about 20 minutes in 3G (EGPRS) network.

In the study delivering only text or text with one or two photos, the mobile delivery worked out without major problems both in cellular and wireless broadband networks (WLAN, Wireless Local Area Network). However, problems were encountered when the article contained a large video clip in addition to text. Participants experienced the problems with network connections as a very slow or interrupted upload. Upload times were in extreme cases over one hour and often upload was interrupted at that point. Based on these experiences one journalist commented the critical role of the reliability and performance of wireless connectivity:

"Mobile Journalist Toolkit would fit to professional use, if the videos would move faster. The journalist or the newspaper cannot afford that the system does not work in the field, and you have to wait for the transmission for a 1,5 hours. When the submission of the video stopped, I immediately thought about a real situation in some sports event, where you have to submit an interview and start working on a new one, but the previous video does not go anywhere." Journalist 7

Personal, user-related criteria

In addition to using the contextual high-level goals as evaluation criteria for the mobile system, we identified personal, user-related factors that affected the user experience. The most influential factors were related to enabling of ambition, support for professional goals and fit to and enhancement of image. Participants also described various emotions in relation to these themes, such as frustration, embarrassment, or pride.

Enabling of professional ambition

News journalists and news photographers are ambitious in their work. Their work is creative and for photographers artistic as well. The general goal is to create relevant and insightful news journalism, reflecting the values present in news journalism.

Some journalists expressed that using the mobile journalism system gives them more possibilities to create meaningful stories. This is due to the possibility it creates to capture also multimedia content and make a complete story with photos and videos, enabling new ways of carrying out their work. Some professionals may find this motivating and providing new possibilities for professional ambition. By contrast, the photographers were dissatisfied and expressed frustration with the limitations of the mobile multimedia device for capturing photos with high quality. One of the most ambitious photographers described how the mobile device affected her ambition and attitude towards photographing:

"I somehow lost my ambition [for photographing] with N82. I think that it is affected by the fact that I am not used to photographing with a device, which you only hold in your hand and do not look through it. I cannot adjust everything the way I want, so everything else goes with a negligent attitude… I do not use a pocket camera either at work or in my leisure time." Photographer 6

She also expressed that the dissatisfaction she feels is due to the fact that she personally has higher expectations than what is achievable by the mobile phone. Similarly, a journalist with a background in visual journalism described how she could not feel proud of her work and would feel a need to explain to externals why her photos look like they do:

"I was disappointed with the quality of the photos when I took a closer look at them. It was possible to process them, but I was not proud of them. It felt like if someone takes a look at them, I would probably start explaining that I had to do it with a camera phone, so that's why they look like this." Journalist 5

Another photographer expressed how he looses the control over the photo due to the limited adjustments of the camera:

"It feels inadequate, if I go on a shooting trip only with a camera phone. Using a camera phone forces to simplicity, since there are no possibilities for adjustments… The control over the photo is taken away from me, since it's not possible to do adjustments. If you have the right attitude towards using N82 or some other camera phone, the result is reasonable content wise if you do not think about the quality of the photo." Photographer 12

This exemplifies how the match or mismatch between ambition and what the used technology enables or is capable of affects the user experience.

Support for professional goals

Support for professional goals emerged as one of the themes important for the user experience. It is a theme which is linked to ambition as well as journalistic quality, however, the tone differs. Several students of journalism mentioned that their own professional goals are not related to the used technology or devices, but to the content itself.

In general, journalists were pragmatic in their view to using the mobile system. No matter what the used technology is, the job is done. On the other hand, they also discussed the limitations set by the system which they felt to affect the quality of their writing as discussed on error-freeness and journalistic quality.

On the contrary, the photographers were more critical towards using the mobile system in their work due to its effect on the quality they have as their own goal. These are illustrated by comments of two photographers:

"My professional goals for the quality are higher than what the camera of N82 can offer. Of course it depends on if you do it for a printed newspaper or for a blog." Photographer 11

"The quality that can be achieved with N82 does not match my goals. In principal, the quality is evaluated by the customer. If the material is good enough for the payer, it is of sufficient quality for the purpose in question." Photographer 12

These comments also illustrate how different criteria exist – in this case own personal needs and goals in contrast to external factors, which affect the evaluation of the system. In this case the external criteria, which may even be in conflict with personal goals and needs, mentioned are the target publication and the customer's (or organization') request and criteria for the quality. Therefore, the user's own professional goals and the perceived quality of the created material are not absolute as evaluation criteria, but modified by external factors. In general, goals and satisfaction with the outcome are relative to the reporting situation, to the relevancy and newsworthiness of the material and to the purpose it is used for. However, from the point of view of being personally satisfied with and proud of the achievement, the personal goals are likely to be more important for subjective quality perceptions and evaluation.

Fit with and enhancement of professional image

Participants also discussed the connection between the smart phone and the image of a journalist and a photographer. Image here refers to whether the use of the mobile system enhances the image and status of the user to relevant others in different usage situations. In case of news journalists and photographers, typical usage situations are interviewing, capturing multimedia or working with the mobile system in public places. Relevant others can be other professionals, interviewees or other externals present in the usage situation.

Journalists traditionally use in their field work a pen and a notebook, and occasionally a voice recorder. The use of mobile technology, in this case, the mobile phone and the wireless keyboard, in the field environment is new and even exciting. One of the journalists described the use of the mobile journalism system as giving a positive image, enhancing status and making one feel proud:

"I saw her in the canteen making a story with N82. It looked pretty cool, since she just put the N82 on the Bluetooth keyboard and wrote there. Everyone stared at her like "what is she doing?" – she must be really important. Using the mobile journalism system gives a certain image, it looked neat, I'm important." Journalist 9

On the contrary, another journalist with background in visual journalism commented on the signaling of the professionalism:

"When you take the big [systems] camera out, people think that "Aha, he knows how to use it, he must have done some work before, too.", but with the camera phone the reaction is more like "What is this…"." Journalist 5

In many professions, work tools are a symbol of the profession. Photographers typically carry one or several separate camera cases with them on their field trips. In addition, a systems camera or a video camera is a symbol of profession in news reporting situations, comparable to traditional pen and paper of a writing journalist.

Some photographers expressed that using a mobile multimedia device does not fit the image of a professional photographer. The smart phone was described by the photographers as unconvincing. One of them commented:

"It felt like this is not so real, since N82 [mobile phone] is such a small device, so it felt like a toy. I can believe that interviewees question that is it about some kind of testing, since the journalist or the photographer has no proper professional tools with them." Photographer 11

One of the journalists also pointed out, that the used tools communicate not only professionalism, but also the quality of the publication. She felt that a smart phone does not support an image of high quality news publisher in the eyes of the interviewees.

Another photographer commented ironically the fit of the mobile phone to the photographer's image:

"You can get humor out of using N82: I'm a professional and I take out a mobile phone." Photographer 12

It seems that especially photographers felt that as users of smart phones for their work tasks, they would be mistaken for reader reporters or citizen journalists. This would impact negatively their image and status as professionals. However, if smart phones are adopted to the work of the news journalists and photographers, the reactions of externals change and smart phones may become part of the professional image.

DISCUSSION

The goal of our research was to gain an initial understanding of the evaluation criteria for user experience beyond task completion when smart phones are used in mobile news making. We carried out a field study with nineteen participants who used a mobile journalism system prototype to report news to an online publication. Two categories were found that were used as evaluation criteria by the users: contextual high-level goals and user-related factors. The latter are closely related to the hedonic, non-utilitarian qualities in the models of user experience presented by Hassenzahl (2003) and Mahlke et al. (2007). In addition, they are clearly linked to be-goals (Carver et al. 1998) and universal psychological needs as discussed by Hassenzahl et al. (2010). The former, the high-level goals within work context beyond task achievement, are rarely discussed in user experience literature.

We identified three high-level goals in news journalism – error-freeness, journalistic quality and speed – that were used by participants as evaluation criteria for the mobile system. In addition, they are important needs and values in the news publishing. Forsberg et al. (2000) found similar three dimensions – time, content and context – to be important in organizing of the editorial work. The

three presented criteria are related to the utility and usability of the mobile system and infrastructure, as well as the technical and contentual quality of the created and published news items. Earlier research on the use of palm-sized mobile devices supports our findings on for example effects of small screen, interaction style and connectivity to utility and usability (see e.g. Zhang et al. 2005).

The satisfaction with the outcome of usage has been one of the measured items in usability studies (see e.g. Sauro et al. 2009). Our findings on journalistic quality give a deeper level understanding of the criteria used for the quality assessment of news items in the studied context. Participants expressed that the deeper level quality of the content was not affected by the use of the mobile system to the same degree as the technical quality. For videos, the quality criteria were more relaxed than for photos, possibly due to the fact, that participants were not used to capturing news videos with higher quality equipment. In addition, the requirements on quality were situational and relative to externally set criteria or conditions, such as the customers' criteria for the quality, one person doing the work of two or the target publication in question.

Three user-related factors – enabling of ambition, support for user's professional goals, and fit and enhancement of professional image - were found to affect the user experience of the mobile system. Ambition is an important aspect of motivating, creative work, which drives for high-level achievements and is closely related to intrinsic motivation (Ryan et al. 2000). In our study, some photographers expressed that since they were not able to achieve with the smart phone what they wanted, it affected their motivation negatively and lowered the level of their achievement. On the other hand, for some journalists, the opportunity for enriching the stories with multimedia could provide new motivating forms of work.

For photographers, the professional goals were expressed through the quality of the created multimedia. Although shared quality criteria exist in the context of news journalism, also personal criteria exist that are related to user's own goals and on a more general level to professional pride.

For photographers technology is an important enabler and tool for creative work and a means for expression. When the used technology is not able to support the personal goals for quality, either the situation or criteria set by externals, such as the customer, can be used in justifying the usage and quality. The quality perceptions and judgments are therefore situational and subject to being relative to externally set criteria. Hartman et al. (2008) and Hassenzahl et al. (2007, 2008) have similar findings in experimental settings when task and context or regulatory focus are controlled for. Similarly external motivators, such as extra payment, could be used as an "excuse" for using the technology. However, in the longer term, if there is a continuous mismatch between the personal goals, ambition and the used technology, this could potentially lower the motivation, job satisfaction and in general well-being.

Finally, we found that professional image, that is, how well the used technology supports the image and status of the professional, was important for the participants. Some journalists expressed that using the mobile system promoted a positive image. In contrast, the photographers found the smart phone to be unconvincing as a professional tool. Traditionally, the equipment carried and used by a photographer is a symbol of their profession in news reporting situations. At extreme, some of the photographers felt that using a smart phone was in some situations even embarrassing, underestimating their skills and affecting their professional image negatively.

Our findings on fit with and enhancement of the professional image are related to the symbolic association discussed by Crilly et al. (2004) and identification in Hassenzahl's model for user experience (Hassenzahl 2003). It is also somewhat related to the construct of image discussed in technology acceptance research (Venkatesh et al. 2003; Yi et al. 2006). According to Crilly et al. (2004), categorical symbolism is associated with what the device communicates, like expression of group membership, social position and status. In the case of news journalism, the used device communicates both the profession and professionalism to other professionals as well as interviewees and externals present in usage situations. Especially photographers felt that they are not taken seriously if they use a smart phone for capturing multimedia. How important image and symbolism is in real-life for professionals working in news journalism is worth further investigation.

There are several limitations in the study. First, the study was not conducted in a fully realistic setting in a news organization. Although a real publication for a real audience was published, the realism of the work in a news organization may alter the findings, their importance and weightings of criteria. Second, the participants were not full-time professionals, but students in the university. Although all had practical working experience in real news organizations, their view of the work as professionals may be idealistic and the context of the research within their studies may affect their evaluation criteria. Finally, the participants used the mobile system for a very short period. Sustained use after a longer usage period may provide different findings. Due to the limitations, the presented findings can be considered initial.

Further empirical studies on the importance of the found evaluation criteria for user experience in mobile work are needed in real work setting. The relationship between emotions and feelings, high-level goals and needs, affect, attitudes, acceptance, quality perceptions, overall judgments and user experience in general calls for further investigation in work settings. In addition, of interest is how varying work situations and contexts affect the importance of different evaluation criteria. Longitudinal studies would provide more information on the temporal changes of the user experience in work context. Furthermore, the relationship between user experience and job satisfaction and motivational issues calls for further investigation.

CONCLUSIONS

To conclude, when developing systems and evaluating the user experience of mobile systems for mobile work, we need to look beyond task accomplishment. It is important to understand the high-level goals within the studied context as well as the personal, profession related goals and needs. These are used by the users as evaluation criteria for the technology and they are likely to be related to users' attitudes, acceptance, affect as well as intention and motivation to use the technology. In addition, positive user experience in work context is likely to enhance job satisfaction and motivation.

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Paper 2

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Dimensions of Context Affecting User Experience in Mobile Work

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Abstract. Understanding the contextual factors affecting user experience is essential in designing and evaluating mobile systems for mobile work. The aim of this paper is to explore these contextual factors through three case studies: of safety observation at construction sites, passenger transportation with taxis, and mobile news journalism. For each case study we describe the nature of the mobile work and present our findings on the contextual factors that were found to affect the user experience. Based on the results, we present and discuss five dimensions of mobile work context affecting user experience: 1) social, 2) spatial, 3) temporal, 4) infrastructural, and 5) task context. Compared to earlier frameworks of context for mobile work, the social context as well as the infrastructural context was emphasized in our findings. The presented framework elaborates the dimensions of context affecting user experience of mobile systems and services in mobile work in particular. The framework is also applicable for mobile consumer systems and services.

Keywords: context, mobile work, user experience, mobile systems

1 Introduction

The importance of understanding context has been highlighted in many studies in the field of Human-Computer Interaction (HCI) [1], [2], [3], [4]. When a new technology, for example a mobile system, becomes a part of traditional work tasks it is essential to ensure that work activities are appropriately supported [5]. Furthermore, several user experience frameworks and definitions mention context as one of the components affecting user experience [6], [7]. [8]. If the context has not been identified and understood, the use of the mobile systems may fail or the user experience may suffer. However, empirical research on user experience has mainly concentrated on consumer products and services, with only a few focusing on the mobile work context [4], [9], [10], [11], [12].

In this paper, we present our findings from three exploratory case studies on the contextual factors affecting user experience in mobile work. We focused on mobile systems that support the work of mobile workers. The case studies were of safety observation at construction sites, passenger transportation, and mobile news journalism. The data was gathered via observations and interviews. Through these

case studies, we examine the nature of mobile work and present examples of identified contextual factors affecting the user experience. Based on our findings we then present an elaborated framework for the dimensions of these contextual factors.

The rest of the paper is structured as follows. First, we review earlier research on context from ubiquitous computing, user experience and mobile work. We continue by describing the research methods and by presenting the results regarding the contextual factors found to affect user experience in the cases studied. We then discuss and summarize the results by presenting a framework for context in mobile work and describe the identified dimensions.

2 Related Work

The concept of context has been discussed extensively in the areas of Computer-Supported Cooperative Work (CSCW) [13], ubiquitous and context-aware computing [14], [15], [16], and user experience [17] as well as in mobile work [4], [18]. A number of attempts have been made to define context [14], including a standardized definition for the context of use [19]. As Dey states, context is a word that is understood easily but is hard to define clearly [15]. One of the most recent definitions for context is proposed by Bradley and Dunlop [14] for context-aware computing. They propose a dynamic model of context based on the definitions taken from linguistics, computer science and psychology. According to them, the user's contextual world comprises the task, physical, social, temporal, and cognitive context.

Context is also an essential part of the interaction oriented frameworks of user experience. In these frameworks user experience is defined as a consequence of the user's interaction with the product, system or service, which is affected by characteristics of the user and the system as well as by contextual factors [6], [7], [8]. In the case of mobile browsing, Roto [17] identifies four dimensions of mobile context affecting the user experience, namely physical context, social context, temporal context and task context. Roto [17] describes the physical context as being any circumstances that physically affect the use of the mobile browser, such as weather conditions, light, crowds, and noise. Social context refers to the expectations of other people in regard to the user in the present context, such as in a meeting. Temporal context refers to the time period that the user dedicates to the system, but limited by the restrictions of the context, such as a commuter interrupting their usage as they get on and off a bus. Roto [17] uses the term task context to refer to the user's higher-level goal, where mobile browsing is merely one task in accomplishing the goal. She gives the example where a user is going home by a bus and checking the timetables with the mobile browser, but their high level goal is to get home.

Several definitions have been presented for both mobile context [20], [21] and mobile work context [4], [18], as shown in Table 1. For example, the definition of mobile work context given by Zheng and Yuan [4] consists of mobile context (where and when), mobile workers (who), mobile technologies (how), and mobile tasks (what); a definition also supported by other literature (See Table 1). Furthermore, Turel [22] includes users' motivation in his definition of context, which is mentioned as one of the user characteristics in frameworks for user experience [8], [17].

In our study we follow the approach of the interaction oriented definitions of user experience, where user, system and context are the basic elements affecting the user experience. Therefore we separate the characteristics of the user and system from the context. We also follow the currently proposed definition in ISO standardization [23], which defines user experience as "*a person's perceptions and responses that result from the use or anticipated use of a product, system or service*." Contextual factors may significantly contribute to the user's perceptions, preferences, behaviors, accomplishments and even emotional responses to using a mobile system or service.

Table 1. Elaborations of context in the literature.

Authors	Viewpoint	Elaborations of context
Bradley and Dunlop [14]	Context-aware computing	Task context, physical context, social context, temporal context, cognitive context
Forlizzi and Ford [6]	User experience	Social, cultural and organizational factors
Hassenzahl and Tractinsky [7]	User experience	Organizational setting, social setting, meaningfulness of activity, voluntariness of use
Kankainen [8]	User experience	People, places and things surrounding user
Lee et al. [21]	Consumer	Personal (emotion, time, movement), environmental (physical, social)
Roto [17]	User experience	Physical context, social context, temporal context, task context
Turel [22]	Mobile work	Users, time, physical environment (incl. technology and organization), motivations, tasks
Wiberg and Ljungberg [18]	Mobile work	Time, place, tasks
Zheng and Yuan [4]	Mobile work	Mobile context, mobile workers, mobile technologies, mobile tasks

Table 1 summarizes the previously discussed elaborations of context also from user experience and context-aware computing. We can see that definitions of context in different fields have similar components, especially those related to time and place. However, tasks as a contextual component are more strongly emphasized in the mobile work context. Moreover, social context is included in the user experience literature as well as that of context-aware computing, whereas it is missing from the frameworks of context in mobile work related literature. In the case of mobile work, technologies are also mentioned as a part of the context.

User experience has received considerable attention in consumer products and services research. However, there is a lack of empirical research on user experience when using mobile systems for mobile work. The aim of this paper is to contribute to the body of knowledge on factors affecting user experience in mobile work by focusing specifically on the contextual factors. The findings were categorized to form a framework for general dimensions of context in mobile work. Such frameworks have the benefit of making designers, developers as well as user experience experts aware of, and more easily able to identify and evaluate, the contextual factors affecting user experience.

3 Research Methods

The focus of this paper is to explore contextual factors affecting user experience in mobile work and how they can be categorized. A multiple case study approach was chosen as the research strategy [24] in order to gain more generalizable results. Three cases were studied separately between 2006 and 2008 in Finland, of safety observation at construction sites, passenger transportation, and mobile news journalism (see for example [25], [26]). The cases reported here are a part of two larger research projects.

We used two sources for qualitative data in the safety observation and mobile news journalism case studies, namely observations and semi-structured interviews. By observation we were able to study what kind of contextual factors existed in real usage situations and to gain an understanding of how context affects the user experience. Because in the case of passenger transportation the nature of their work meant the taxi drivers could not be observed, focus groups were arranged instead. Semi-structured interviews were conducted to complete the results of the observations and to gain a deeper understanding of the factors affecting user experience. Notes were written during the observations, while the interviews and focus group discussions were recorded and transcribed.

Each case study was first analyzed separately using content analysis and applying both data triangulation and investigator triangulation. The transcribed observation notes and interviews were first read through to form a general understanding of the data in relation to contextual factors. Inductive reasoning was used in giving descriptive labels and assigning them to lines, sentences or paragraphs [27]. These labels were then grouped to higher level categories. We used cross-case analysis [24] and earlier frameworks of context from ubiquitous computing, user experience, and mobile work related literature to form the main dimensions of context from the categories.

3.1. Case Study A: Safety Observation at Construction Sites

At construction sites, we focused on the safety observation process known as TR-measurement [28]. The process is carried out weekly by the industrial safety delegate and the site supervisor on Finnish construction sites and is aimed at reducing the number of industrial accidents.

Two researchers observed the construction workers for two hours at three different construction sites. Altogether there were six participants aged 25 – 60 years old in three observations. They had used the mobile service from between five to 12 months. At the time of the study, they used the mobile service via their mobile phones (Nokia 6630). After the observations, the participants were interviewed for background information and to go over the observation notes.

3.2 Case Study B: Passenger Transportation

In this case study we focused on the work of taxi drivers, where mobile systems play a crucial role in major work tasks such as accepting incoming requests, searching for locations on the map and communicating with dispatch and with other taxis. Installed in the taxis were mobile systems including General Packet Radio System (GPRS) and a touch screen, along with other devices such as a taximeter and an additional touchpad for operating the system.

Two two-hour long focus groups were arranged with taxi drivers. The first group's five participants (one woman, four men) had an average of 20 years driving experience. The second focus group had four participants (all men) whose taxi driving experience varied from 1.5 to 10 years. The focus groups covered questions related to mobile work tasks, and the benefits and usability of the mobile system, as well as possible problems faced while using it.

3.3 Case Study C: Mobile News Journalism

In this case study, ten graduate students of journalism and nine graduate students of visual journalism published an online blog of university events as part of a university course project. Uploading to the blog was done wirelessly directly from the proximity of the reported events. Students used the mobile phone based system for capturing multimedia items, and creating news stories with text and multimedia. The main parts of the mobile journalism system were a mobile multimedia phone (Nokia N82) for photo and video capture, a wireless Bluetooth keyboard (Nokia SU-8W) for writing text, and a research prototype of a mobile software application developed for mobile news creation and submission. A publishing schedule was given by the producer of the publication, replicating the working process of an editorial staff in a newspaper organization.

Three researchers observed eight participants using the mobile system during the first project day, some 24 hours of observations of the mobile work context. Five participants were interviewed before they used the system so as to gather background information, for example, on their earlier experiences of using mobile phones in journalism. Eleven participants were interviewed after the project day to gather information on their experiences including context related aspects. Additional observations of three journalist-photographer pairs and four interviews were made on a second project day a month later.

4 Results

In this section we present the results of each case study. First, we characterize the mobile work in each case, as well as the work community in general. We then describe the contextual factors that were emphasized in the cases.

4.1 Case Study A: Contextual Findings in Safety Observation

Work at construction sites is traditionally mobile; workers move in and out of the building under construction. The safety observation is also mobile as an industrial safety delegate and a site supervisor walk through the site. The industrial safety delegate makes his safety related findings during the safety observation round and the accompanying supervisor documents them, either traditionally by filling out a specific paper form, or by using a dedicated mobile service developed for this purpose. Photos, complementing the written descriptions of the safety issues, are taken either with the mobile phone or with a separate digital camera. The results of the safety observation round are presented to contractors at a weekly site meeting.

The construction sites of course vary according to the specific building under construction, the area of the site, the number of workers on the site at any time, and the overall progress of the project. The progress of the construction affects how long the observation round takes and the volume of the findings. In other words, when the construction is at an early stage, the observation round takes about an hour, and there are less than 100 findings; at a later stage, the round can take about two hours and may have up to 500 findings.

Based on our findings with construction workers, infrastructural factors such as functionality of the network connections and the capacity of the mobile device were highlighted. If the building has floors below ground level, such as a cellar, the network connection may be limited or even unavailable at times. However, since the mobile service used for the safety observation sent data to the server in real time, unavailable or cut network connections got the service stuck and the data was not uploaded. In the worst case, the user had to reboot the mobile device and all the gathered data was lost. In that case, the user had two choices in continuing the safety observation: either they tried to remember all the findings already made, or they started again. This took extra time and the user became frustrated. In addition, the risk of making errors increases when the user has to remember all the findings.

Another infrastructural issue highlighted was the capacity of the mobile device due to the working situation. When the observation round takes approximately two hours, the mobile phone battery must be fully charged before the round begins. Environmental factors, such as cold and humidity, were also a factor on construction sites, since although winter weather did not complicate a safety observation round conducted with pen and paper, it did complicate the use of the mobile service. For example, entering data with gloves on is difficult. To quote one user: *"The less data is required to be entered when using the mobile service, the better"*. One of the users had cut the thumb off his gloves to better use the mobile service in winter time. Humidity in contrast, complicated observation rounds conducted with pen and paper, but not with a mobile service, since rain makes paper documentation difficult to write and read, whereas the mobile device was easily placed in a pocket.

4.2 Case Study B: Contextual Findings in Passenger Transportation

Taxi drivers' main task is to drive customers from one place to another throughout the day and night, a very customer-orientated service. They accept incoming requests and

search for locations on the map with their mobile system. Taxi drivers work in the middle of the traffic with their peak hours being nights and weekends, whereas during the week and the daytime it is quieter. In Finland the taxi owners usually hire one or more drivers. Both the owners and the hired drivers drive the cars, so the users of the mobile system in any given car may be very different. There are, for example, older drivers that have driven taxis for years, and have used older technologies for their work tasks. Younger drivers are usually familiar with computers and new technology and are more at ease using new systems.

We found social factors to be important for taxi drivers. Taxi drivers see each other, for example, when they are waiting for possible customers at a railway station, or when they arrange to have a coffee break together. They also communicate through their mobile system by sending text messages to each other. However, due to the lack of support for more private channels between the members of the work community, some of the participants find this communication disturbing. Moreover, unnecessary messaging was also seen to affect driving safety. In addition to messaging, drivers can also follow where their colleagues are through the mobile system, and in this way they can meet each other when they have a break.

Because taxi drivers' work has long traditions, they also have a strong culture among their work community. In related cultural traditions and respect for customers, one taxi driver gave the example that they are supposed to "*get out of their car, open the door for customers, and talk to them*". According to the interviews, this is more important to them than knowing where a specific street is located. They value their customers and they have also been guided to minimize the use of the mobile system when customers are in the taxi. One driver said: "*Prodding at the touch screen draws too much of the customer's attention*", and customers may think that the driver is not interested in them. Instead of using the touch screen, many drivers use their mobile system via a touchpad located between the two front seats under the driver's hand, which is therefore less visible and less noticeable to the customers.

Taxi drivers are also proud of their professionalism. As one taxi driver said: "*The system cannot guide us by giving, for example, information about the travel time or travelling in general"* (for example, how long it takes to drive the customer to the destination). Accordingly, they do not want the mobile system to guide them too much, because they think they know which way to drive better than the system does.

According to our findings, environmental factors were highlighted in taxi drivers' work. Sunshine, for example, makes the work of taxi drivers difficult at times. As one taxi driver stated: *"If the sun is shining low and you have a light colored shirt, the shirt reflects the sunshine on the screen."* On the other hand, at nights or in the dark the brightness of the screen disturbs the driver if they do not use a screen saver. However, not all taxi drivers were familiar with the screen saver and therefore not all used it. Winter too, makes the taxi drivers' mobile system difficult to use as coldness causes it to boot up very slowly and it takes time to start the work.

Another important contextual factor related to system usage in the taxi drivers work was safety. As one taxi driver said: "*Every additional button press is a safety risk*". If taxi drivers are required to take their eyes off the road when they use their mobile system while driving, the safety risk increases. Moreover, too small a font size also affects safety, because users have to narrow their eyes to read the text in the display.

4.3 Case Study C: Contextual Findings in Mobile News Journalism

The work of news journalists and photographers is highly mobile by nature. In the field, an essential part of the work is to gather the material needed for reporting a newsworthy event. Traditionally, a news journalist uses a pen and a notebook for taking notes and occasionally uses a voice recorder for capturing interviews. On the other hand, a news photographer carries a digital camera and lenses in a camera bag and occasionally a digital camcorder for capturing news clips for the on-line version of the paper. Usually journalists and photographers return to the newsroom to write the story or to select and process the captured photos or videos on desktop computers. However, the work of news journalists and news photographers is changing, due to the increasing speed of news publishing, where Internet publishing may require instant reporting and submission of the material from the news scene. Therefore using mobile multimedia phones and services is of interest in this area also.

The work in a news organization is characterized by a fast pace, unexpected events and ever-changing plans. To manage the work of the editorial staff and publishing, publication schedules are drawn up and work is tied to deadlines to allow the timely printing of the newspaper. The pace of the mobile work varies from slow to hurried, covering phases from idle waiting to the moments of rushed work when the deadline is drawing near or when one needs to hurry in submitting time-critical material to an on-line publication. In on-line and mobile news "*the deadline is now*" as one of the interviewees stated.

In journalism the mobile system, in this case the mobile phone, the wireless keyboard and the mobile journalism application, is primarily a means to achieve a higher-level goal, like rapidly reporting news to the on-line publication. The mobile system, service and the related infrastructure should therefore support the achievement of these goals. Based on their usage experiences participants emphasized the need for reliable and high performance in the submission of the material. Problems encountered in the study, such as upload times that took over an hour or were interrupted, were partly due to insufficient throughput in submission and in the worst cases prevented the participants carrying out their next assignment or capturing newsworthy material. In addition, we found the editorial process as well as the publishing system to affect the user experience of the journalists and photographers. These need to compensate for the limitations of the mobile system, such as the spelling errors due to writing text with the mobile system.

The reactions of external persons in various forms were important for the users and how they felt about using the system. In their field work, both journalists and photographers work among other people, including their audience and occasionally colleagues from other news organizations. Journalists and photographers are in direct contact with their interviewees, or those they capture in photos and video clips. Participants felt that the mobile system was less visible to others in multimedia capture due its everyday like character and therefore they stated that in certain situations they could more easily fit into the crowd. On the other hand, using a mobile phone made some participants feel that they had lost a symbol of their profession: a large and visible camera. Most of the participants also mentioned that due to the familiarity of the mobile phone, their interviewees were more relaxed when they were photographed with the mobile phone than when they are photographed with a camera.

The locations the participants worked at varied from quiet spaces, like the library or the offices of the university staff being interviewed, to noisy hallways and canteens. To work with the material they had gathered both journalists and photographers typically looked for a nearby public space with chairs, sofas or preferably with tables, like cafes. One journalist described this: "*Although you can carry the system to any place, you still need the space and time to work*." The public spaces chosen were often crowded and noisy with interruptions and disturbances from people talking and passing by. In addition, journalists' working positions while writing were dictated by the environment. Journalists had trouble in placing their needed items, such as mobile phone, foldable wireless keyboard and traditional notebook, into a stable position on their laps if no table was available. The keyboard had no locking mechanism and therefore it started to fold easily while writing. There was also no mechanism for fastening the phone to the keyboard for this type of usage situations (see also Figure 1).

The environmental conditions emphasized by the participants were related to the temperature, lighting and ambient noise when using the mobile system. Photographers commented especially on lighting as an important element for capturing stills and video clips, as if it is too dim or too bright the quality of the captured photos and videos suffers due to the technological limitations of the current mobile phone - or it may not even be possible to capture multimedia material with sufficient quality for publishing. Photographers also emphasized the significance of relatively low ambient noise level for capturing video clips due to the limitations of the microphone. The handling of the mobile system in freezing weather was mentioned to be clumsy with cold fingers and it is not possible to wear gloves when working with it. In addition the battery life was mentioned as being shorter in freezing weather.

5 Discussion

In the previous section, we described our case study findings regarding the contextual factors affecting user experience. In this section, we discuss the results and categorize the findings under five dimensions of context relevant in mobile work. In addition, we discuss design implications arising from the findings.

We categorized our findings of the contextual factors affecting user experience in mobile work under five main dimensions, namely 1) social, 2) spatial, 3) temporal, 4) infrastructural, and 5) task context. These five dimensions are illustrated in Figure 1 with a summary of the findings from the three case studies. The presented framework, with its five dimensions (Fig. 1), elaborates upon the approaches in earlier frameworks of context (see Table 1). Compared to these earlier frameworks, two new dimensions are brought in, namely the social and infrastructural contexts. As discussed in Section 2, social context is highlighted in user experience frameworks [6], [7] and in context-aware computing [14]. Forlizzi et al. [6] as well as Hassenzahl et al. [7] also mention organizational and cultural factors, which we find to not be separate dimensions of context, but rather to be related to and affecting in the other dimensions of context. Infrastructural context has not been part of the earlier

frameworks, although there are references to technology as being part of the context. In the following section we discuss the dimensions of the framework in more detail.

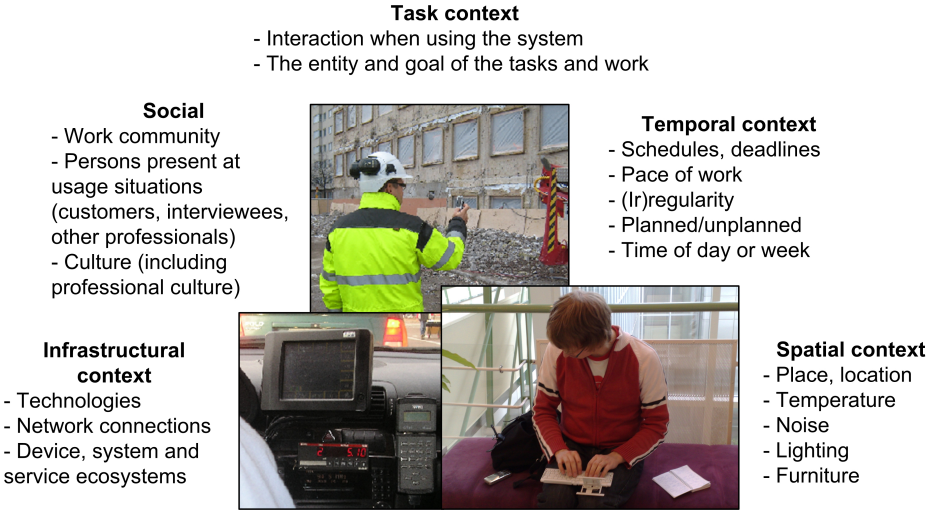

Fig. 1. Contextual factors affecting user experience in mobile work.

Social context. We found that the presence and reactions of external persons affected both the usage and user experience of the mobile systems. These external persons involved were either in direct contact with the user or indirectly present at the work situation. In our cases the persons who were directly involved with the users in usage situations were taxi passengers, interviewees and persons of whom photos and video clips were captured. Moreover, indirectly present were, for example, construction workers, colleagues or bystanders when reporting news in the field situations. For example, taxi drivers limited the usage of their mobile system when customers were present and preferred to use a conveniently placed touchpad, which drew less attention from the customer. In the case of journalism the participants found that their interviewees were more at ease when they were photographed with a mobile multimedia phone. We found also, that the work community and unofficial mobile communication with colleagues was important, especially in the case of taxi drivers. This also supports the earlier studies of the importance of the need for social communication in mobile work [9] [18]. Taxi drivers communicated with their colleagues through the mobile system by text messages, even though the system was not initially designed for social communication. Moreover, the professional and organizational cultures affect the values and norms of the professional community.

Spatial context. This refers not only to the location where the mobile system is used, but also to the environmental conditions and circumstances, such as available furniture, affecting the work situation and therefore the user experience. Environmental issues, such as temperature, noise, and light affect the use of mobile systems. The effects of cold upon the use and performance of the mobile systems were mentioned in all cases. When capturing multimedia material, lighting and sound conditions especially have an effect on the quality of the captured material. This was

particularly emphasized by the news photographers, for whom the quality of the captured multimedia material is very important.

Temporal context. Temporal factors are related not only to the absolute time of day, week or year, but also to schedules and deadlines as well as the pace and regularity of the work. In the case of news journalism, the organization sets schedules and strict deadlines for the news reporting. The pace of the work can also vary due to, for example, external reasons not controllable by the user, like an interviewee being late for the arranged meeting. Plans and schedules may suddenly be changed and cause extreme moments of rushing to accomplish the new assignment. For the taxi drivers the time of day or week affects the pace of the work, nights and weekends being busier for them; whereas the safety observation rounds at construction sites are done regularly on a weekly basis.

Infrastructural context. The infrastructural factors, especially the functionality of the network connection was important in safety observation and in mobile news journalism. Unavailability, unreliability or other performance related problems of the network make the users frustrated and unsatisfied. Problems in network connections or throughput of the devices may force the users to redo their work tasks or prevent the users of accomplishing further tasks. Further examples of infrastructural context are carrier related costs and in some countries legal circumstances which regulate the use of the mobile system or service and therefore affect the user experience. In the case of mobile news journalism there exist also other systems and processes, including the editorial system and the editorial process, which affect the user experience of the mobile worker. The entire ecosystem of used mobile devices, systems, and services as well as related other systems and work processes could therefore be seen as part of the infrastructural context.

Task context. The task or set of tasks that users carry out with their mobile systems are often only part of higher level goals they have in their work [17]. In the case of news journalism the main tasks for a journalist that are designed to be accomplished using the mobile system are to capture photos or video clips, write the text for an article, add the multimedia items into it and then submit it to editorial. However, the actual goals in reporting news are related to the content and meaningfulness of the news, photos and videos to the audience as well as to the journalistic quality, like error-freeness, of the published material. This type of goal cannot be accomplished by any system alone, rather the user is in the key role - quoting the words of a participant of a mobile news journalism study - of "*using brains*" as well as the entire work process. Therefore, understanding both the tasks and the higher level goals is important in designing mobile systems that support the mobile work tasks. However, understanding the diversity of higher level goals especially in non-routine, creative work also simultaneously explains why mobile systems sometimes cannot be designed to support all the goals of their users. This is especially the case when both professional goals and personal ambitions are present.

Implications for design. In the light of the presented contextual dimensions and findings from the study, we present implications for design when developing mobile systems for work purposes. First, regarding the social dimension of context, the mobile systems should be acceptable both for the actual users and also for other people around them. Moreover, results indicate that social communication is important for mobile workers, and something that could be supported by providing

private channels for communication. Second, the total attention required to operate the mobile system should be minimized so as to not only maintain the safety of the mobile workers but also of others. Third, mobile systems should support working in different temporal situations allowing flexible and reliable use, especially when in a hurry or when several tasks need to be performed simultaneously. Fourth, optimizing the mobile system and service for maximum throughput in data transmission is of essential importance. Fifth, the real usage environments and situations should be studied, to ensure that the developed systems and services are operable in them. For example, especially in case of mobile workers, users often move during the task or data transmission and therefore the used network connection may not be available at all times. Moreover, due to the work in the mobile field conditions, the drain of the mobile system should be minimized so as to extend the device's battery life. Sixth, designers should identify and define the environmental circumstances in which the mobile services are intended to be used. Spatial factors, such as cold and lighting conditions, can be managed, thus allowing the users to control the characteristics of the user interface and to personalize them. Things sometimes taken for granted when writing with mobile systems, like tables or other furniture, are not always available in usage situations.

The dimensions of context presented based on the cross-case analysis of the results are not the only way to categorize the contextual factors affecting user experience. However, we found the five dimensions capture our findings well and the presented dimensions can be used when analyzing and defining the contextual factors in the mobile system and service development. With the help of the framework, for example design heuristics for designing successful mobile services for mobile work and questionnaires for measuring user experiences can be prepared. Although three case studies were used in the analysis, more studies are needed to gain an insight into the similarities and differences between different fields of work as well as defining a more comprehensive list of factors within the dimensions of context. In addition, different cultural and ethical issues may affect the findings and therefore similar studies in different countries would bring interesting new insights regarding the contextual factors. Due to the relatively small number of participants in the cases, the findings can be seen as examples, but they do serve well in this purpose, although especially in the case of the mobile news journalism a further study with professionals working for newspapers is needed. We believe that the reported findings from these three different types of mobile work help in understanding the diversity of contextual factors affecting the user experience in mobile work when using mobile systems for work related tasks. Further studies are needed to verify the applicability of the framework for identifying the contextual factors which affect user experience when designing and evaluating mobile systems and services.

6 Conclusions

To explore the nature of mobile work and the contextual factors affecting user experience in different areas of mobile work, we conducted three case studies with construction workers, taxi drivers, and mobile news journalists and photographers.

We described the contextual factors that were emphasized in each case study, with the presented results giving examples of the variety of contextual factors affecting user experience. We categorized the findings under five dimensions of context, which were found to affect user experience in mobile work. These five dimensions are 1) social, 2) spatial, 3) temporal, 4) infrastructural, and 5) and task context; they elaborate earlier frameworks for context, and also emphasize factors related to the social and infrastructural dimensions.

Understanding the contextual factors affecting user experience is important in designing and evaluating mobile systems and services. The five dimensions of context presented here can be utilized as a general framework when identifying more specific contextual factors as well as when evaluating the user experience of mobile systems and services. Further empirical research on context would increase the knowledge on similarities and differences in the contextual factors affecting user experience and on the applicability of the framework and its dimensions also in other fields than mobile work.

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Paper 3

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Developing Practical Tools for User Experience Evaluation – A Case from Mobile News Journalism

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ABSTRACT

We present a questionnaire called Attrak-Work to support the evaluation of user experience of mobile systems in the context of mobile news journalism. We discuss theoretical background of the questionnaire and describe the development process including the field study within which the questionnaire was developed. The presented questionnaire assesses user's perception of the pragmatic (usability and task and goal achievement) and hedonic (stimulation and identification) qualities and an overall judgment of appeal. We used the questionnaire as part of a field study to corroborate and expand the findings of observations and interviews. We found the Attrak-Work questionnaire a useful tool to be used in this manner especially for the evaluation of the hedonic qualities.

Keywords

User experience, evaluation, work, mobile phone, journalism.

ACM Classification Keywords

H.5.2 [**User Interfaces**]: Theory and methods, Evaluation/methodology. H.5.1 [**Multimedia Information Systems**]: Evaluation/methodology.

General Terms

Measurement, Theory, Human Factors, Design.

1. INTRODUCTION

There are many well-established ways to evaluate the usability of interactive systems including questionnaires (e.g. [17]), but evaluating experiential aspects such as fun, meaning, or beauty is a much less covered topic. Focusing on user experience and evaluating the experiential aspects helps for example maturing industry sectors to differentiate from competition and gain a loyal customer base. Without means to evaluate user experience, it is impossible to manage experience related aspects. As the need for systematic user experience evaluation is high both in industry and academia, user experience evaluation has gained increasing attention in Human-Computer Interaction (HCI) [6],[9],[11].

It is still unclear what the appropriate methods and metrics are for assessing user experience. This is partly due to the fact that there is still not an agreed definition for user experience, although standardization work is ongoing. There are for example methods for assessing person's momentary emotions or emotional trajectories [1] during interaction, which provide interesting information for content developers such as game narration designers or movie directors.

Not all products are designed to trigger a specific emotion, however, but to provide valuable and meaningful experiences in a broader sense [2]. For example, a mobile journalist might aim at generating a certain story experience for the audience, but the text and image capturing and editing tools that s/he uses are not targeted to raise specific emotions. A work tool is often primarily seen as a means to an end, having instrumental value. Not surprisingly, the evaluation of user experience with questionnaires in mobile work context has concentrated mainly on usability aspects with a few exceptions reaching beyond it [10], [15], [21].

The field work of news journalists and photographers has always been highly mobile. Advances in mobile technology, with converged devices, interoperability and fast mobile and broadband network connections enables journalists and photographers to use mobile tools for news reporting from the field. These tools can be used for capturing of photos or videos, creating stories, and submitting or even publishing them directly from the field. Instead of a van full of equipment, light tools such as a laptop or even a mobile phone can be used for producing the stories. Journalists and photographers do not necessarily return to the newsroom to deliver their stories but for example email them to the newsroom or even publish them right from the field [20], [22]. The ad-hoc and timely nature of mobile reporting brings a new flavor to journalism.

We conducted a field study with a mixed methods research design [18] to explore user experience with a mobile journalism system. Nineteen participants used a multipart mobile system based on a mobile multimedia phone for submitting and publishing news items to an online publication on two project days. One of the goals in the study was to create a questionnaire for assessment of users' perceptions of mobile system qualities and overall judgment of mobile systems used in the context of mobile news journalism. Our intention was to use the questionnaire for corroboration and expansion of the results from the qualitative data and to build a tool to be used

in the evaluation of user experience in our future studies in the context of mobile news journalism.

We chose Hassenzahl's model of user experience [5] as a starting point for the questionnaire development. We started by analyzing the collected observation and interview data with Hassenzahl's model as a guiding theory. Based on the findings we refined the model and developed the Attrak-Work questionnaire. Questionnaire was conducted at the end of the field study as one part of an online survey targeted at the participants of the study.

In this paper we present the theoretical background and the phases of the questionnaire development as well as exemplary results of using the Attrak-Work questionnaire. We also discuss critically many of the limitations in the development of the Attrak-Work questionnaire, which reflect the challenges of fitting questionnaire development into a relatively short period of time.

2. THEORETICAL BACKGROUND

Questionnaires are frequently used in various types of user studies in HCI. A variety of questionnaires have been developed for evaluating users' emotions. The affect grid [14] assesses emotional states with a 9 x 9-matrix that is surrounded by eight adjectives describing different emotions. A Semantic Differential Scale [13] is a type of a scale with which users can rate the system based on bipolar word couples. For example Mehrabian and Russell [12] have used the Semantic Differential Scale with 18 adjective pairs for emotion assessment against valence, arousal and dominance. Instead of words pictures have been used in emotion assessment questionnaires to avoid language difficulties [3], [8].

Emotion assessment is not the only way to evaluate user experience. When we aim to improve a system or want to gain an understanding of the user experience, we are also interested in users' perceptions of the product's qualities and their overall evaluative judgments of it. To be able to reach beyond studying the instrumental aspects, practical tools that support the assessment of user experience are needed. One approach is to include hedonic aspects in the measurement, like in the HED/UT scale [16], [19] or the AttrakDiff questionnaires [6], [7]. These questionnaires aim to assess users' perceptions of the product or system qualities.

AttrakDiff questionnaires are based on the user experience model presented by Hassenzahl [5], which is illustrated in Figure 1. We chose this model as the basis for the development of the tool for user experience evaluation in the context of mobile news journalism. Hassenzahl's model enables a relevant approach to studying aspects of user experience in work context, since the theory covers not only pragmatic (utilitarian) aspects, but also hedonic (non-utilitarian) aspects. For professionals not only the functional aspects of the used technology are important, but also how it relates to being stimulating, supports and enables creativity and, on the other hand, what kind of symbolic value it possesses.

Hassenzahl's framework is based on the assumption that product character can be described by two attribute groups, namely pragmatic and hedonic attributes [5]. Each person constructs her own personal version of the product character based on the product features and on her personal standards and expectations. *Pragmatic quality* is *instrumental* and related to the product's *usability and utility* when the product is used for tasks. On the contrary, hedonic quality is related to the user's self, such as autonomy, competence, relatedness to others, or security [4],[5].

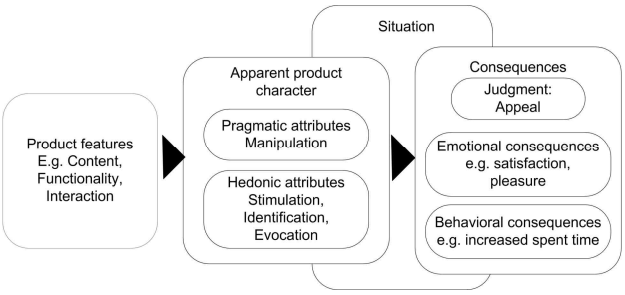

Figure 1. Key elements of Hassenzahl's model of user experience from the user perspective. Source: [5]

Hedonic quality focuses on aspects of stimulation, identification, and evocation [5]. *Stimulation* is related to personal development, that is, to curiosity, personal growth, development of skills and proliferation of knowledge. *Identification* addresses the expression of self and the user's personal values to relevant others through objects and is therefore social. An example of this in the context of journalism is a photographer's systems camera and the big camera case(s) he carries with him, which serve as symbols of his profession. *Evocation* refers to the product's ability to provoke memories such as important past events or relationships.

According to Hassenzahl, the subjective perception of the product character leads to consequences such as judgments about the product's appeal, goodness and beauty [4], [5], as well as emotional and behavioral consequences. As examples of emotional consequences Hassenzahl discusses satisfaction and pleasure [4],[5]. Based on the model, Hassenzahl presents two versions of AttrakDiff questionnaires, for assessing the attractiveness of products [6], [7]. The first version, AttrakDiff includes two attribute groups, that is, one group for pragmatic and another for hedonic, as well as one group for the judgment of appeal [7]. The second version, AttrakDiff2, separates the hedonic attribute group into two groups, one for stimulation and the other for identification [4], [6]. In addition, evaluative constructs such as goodness and beauty have been included in subsequent studies [4]. AttrakDiff questionnaires use a Semantic Differential Scale to assess the pragmatic and hedonic attributes as well as items in judgment of appeal and the evaluative constructs.

Although AttrakDiff questionnaires have been used by several researchers in studying user experience, we decided to use the original model as a basis for questionnaire development instead of using the AttrakDiff questionnaires. This decision was made, since when we used Hassenzahl's model as a guiding theory in analysis of the data, our findings on hedonic aspects differed considerably in their representation from the attributes in AttrakDiff questionnaires. Therefore, we used our findings in the development of the questionnaire. In the following sections, we first present the study and continue by describing the development of the questionnaire within it.

3. STUDY

We used the case study approach [23], which was carried out with a mixed methods research design [18]. Data was collected during a field trial by qualitative (semi-structured interviews,

observations) and quantitative (questionnaires) methods. Questionnaires were used in the research design to corroborate and expand the results obtained from observations and interviews. Data was collected before, during, and after the usage of mobile system. Figure 2 illustrates the data collection methods used in different phases of the study.

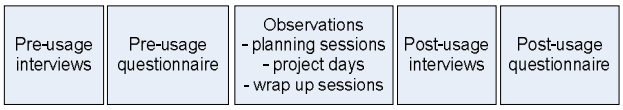

Figure 2. Data collection of the study.

Study was made in conjunction with a graduate level university course on web publishing in the Department of Journalism and Mass Communication at the University of Tampere, Finland. Data collection centered around two project days, when the students produced short news stories and videos for a web publication using a mobile journalism system based on mobile multimedia phones. The mobile system consisted of a mobile multimedia phone (Nokia N82), a wireless Bluetooth keyboard (Nokia SU-8W) and a mature prototype of a mobile journalism software application running on the mobile phone. Application enabled the creation of news stories with text and multimedia items (photos, audio and video clips) on a mobile phone and submitting of these stories to the publication platform.

During the two project days graduate students worked as journalists and photographers creating news stories to the publication from the field. University course was chosen as the context of the field study, since the mobile system was a prototype. It was not feasible to set up a trial in a news organization at this phase, since potential problems encountered may had disturbed the work of the professionals considerably. Researchers did not influence the decisions on the type of stories or how or for what purposes the participants used the system. The publishing process therefore was similar to the one which is used in real news organizations with editorial meetings (here planning and wrap up sessions) and with the roles of editorial staff (online producer and art director) included. See for example [20], [22] for more details on the study.

3.1 Participants

Participants of the study were graduate students of journalism and visual journalism who were taking a project course on web publishing. All students had practical experience in journalistic work either full time (1-15 years, median: 1 year) or part-time (0-4 years, median: 2 years). Most of them were working as freelancers in parallel to their studies. The students of visual journalism had used mobile phones (Nokia N93) earlier in their studies for video capturing and editing, whereas the students of journalism had no prior experiences of using mobile phones in their studies. From here on we refer to the students on journalism as journalists and to the students of visual journalism as photographers.

The number of participants in the study was nineteen (10 journalists, 9 photographers). The number of respondents to the online survey, which included the Attrak-Work questionnaire, was fifteen (8 journalists, 7 photographers). All interviewees and respondents were given as a compensation a ticket to movies.

3.2 Data Collection

As can be seen from Figure 2, data was collected using multiple methods at various points during the study. The study centered around two separate project days in the spring 2008, which were five weeks apart. Pre-usage interviews were arranged three days before the training of the mobile journalism system for two groups separately, one for two students of visual journalism and one for three students of journalism. The goal was to familiarize with the field of the study, participants' usage of mobile phones, prior experiences of using mobile phones in news journalism, expectations as well as attitudes. Results were used in the development of a pre-usage questionnaire, which was conducted as a paper questionnaire right before the training. All 19 students answered the questionnaire which was used to collect background information of the users, their prior usage and experiences of mobile devices and services, and expectations and attitudes towards upcoming project.

Observations were made on two project days, on two planning sessions a week before each project day, and on two wrap-up sessions a week after each project day. Three researchers were involved in the field trial during the first part of the study and four researchers in the second part of the study. A total of 85 hours of observations were made both in the mobile context (journalists and photographers working) as well as in the "newsroom". Researchers made hand-written notes and took photographs when observing the work. Within three days of the first project day eleven participants and during the second project day four participants were interviewed. Interviews were semi-structured lasting from 60 to 90 minutes. All interviews were recorded. Interviews covered various user experience related themes as well as users' perceptions on the suitability of mobile phones in journalism.

The post-usage questionnaire was conducted as web survey with a deadline for completing it within ten days of the second project day. Participants of the study were sent an email asking to complete the survey two days after the second project day. A reminder was sent by email two days before the deadline. The questionnaire consisted of several parts, of which one was the Attrak-Work questionnaire which began from the second question in the survey.

3.3 Analysis

The data from the observations was written into electrical form for further analysis and the interviews were transcribed. Interview and observation data were analyzed by content analysis. Specifically for the case of developing the questionnaire, data analysis was guided by theory to identify themes and attributes related to pragmatic and hedonic aspects (stimulation and identification) of the mobile system usage. For this article we used Cronbach's alfa for testing the internal consistency reliability of the scales and nonparametric Mann-Whitney U test for identifying statistically significant differences between the user groups on their perceptions of the system's qualities and overall judgment of appeal.

4. DESIGNING THE QUESTIONNAIRE

The process of developing the user experience questionnaire for mobile news journalism included several phases: first, gaining an understanding of the factors affecting user experience with exploratory, qualitative methods. We used Hassenzahl's model of pragmatic and hedonic product qualities

as a guiding theory in the analysis phase. We then built a framework for the instrument development from our findings and based on earlier theories [5],[11]. Finally, we developed the questionnaire based on our framework and on the findings from qualitative data. This section gives an overview of these phases.

4.1 Findings from the qualitative data

In this sub-section we present a short overview of the findings related to the pragmatic and hedonic aspects of using the system based on the observations and interviews.

4.1.1 Pragmatic quality

Themes that were emphasized by several participants regarding pragmatic aspects of the mobile journalism system were for example ease of use, learnability, reliability, intuitiveness of use, performance and effectiveness. Support for the task, work process-related themes such as effect on working, and, in particular, reaching higher level goals of news journalism were discussed. On the mobile system level, these themes addressed the features and functionalities of the used mobile system as an entity or its sub-components, such as the keypad, camera or the mobile journalism application. Users described the usability-related aspects for example with words like *easy, intuitive, cumbersome, unreliable and fluent*. Furthermore, the themes related to carrying out the tasks or achieving goals covered for example effect on working and on the speed of publishing, support for working and the efficiency of the system.

4.1.2 Hedonic quality - Stimulation

In addition to pragmatic aspects, participants mentioned several aspects related to the hedonic qualities of the system and its usage. Participants described the usage of the system as *interesting, (un)motivating, spontaneous, liberating, enchaining, exciting, frustrating and restricting*. These aspects were clearly related to the user's own self and his or her experience of using the system for capturing the material and for making the publication. Journalists took a very practical stand to using the mobile system, whereas photographers were more negative and reserved towards the system. Participants also emphasized that technology is essential for photographers to do their job. Due to the limitations in the technical capabilities of the mobile phone, photographers expressed that it restricts or even enchains their expression and creativity, and they found it non-motivating not to be able to achieve what could be achieved with "proper" tools. On the other hand, some photographers commented that using a simple device with limited capabilities was also in some sense liberating for them. However, both journalists and photographers expressed that using the mobile phone for capturing videos gave them new possibilities for news making and it was therefore found interesting and motivating for the specific purpose.

4.1.3 Hedonic quality - Identification

Themes of hedonic identification that were emphasized in this study were related to communicating profession and status. For photographers, the systems camera, besides being a practical means and an important enabler of their job, is a symbol of their profession in a social context. It *communicates professionalism* both to the interviewees and other outsiders, including other professionals. Photographers and journalists also talked about the *reactions of outsiders* to using the mobile phone for multimedia capture. Participants described the reactions of outsiders to vary from neutral to surprise and disbelief. References to outsiders addressed two different groups, that is, the people they were interviewing and shooting photos and videos of, and other outsiders, either ordinary people or other professionals that were present in the usage situation.

When using mobile phones, in this study both photographers and journalists expressed that interviewees who were laymen and may had never been interviewed or photographed before by the media were more at ease with the small and everyday like device than with a systems camera. Participants felt that interviewees were also less reluctant to be interviewed and photographed. Participants therefore *reflected on outsiders' reactions and comments* as well as *anticipated reactions and attitudes towards mobile phone users*.

4.1.4 Evaluative judgments - Appeal

As exemplified above, we found both pragmatic (utilitarian) and hedonic (non-utilitarian) themes and qualities related to the use of the studied mobile journalism system in mobile news journalism. The perceptions of these qualities are subjective, and they are related to a person's overall judgments of the mobile system. Based on the findings from qualitative data, there is a difference between the two user groups of the study, journalists and photographers, regarding the perceived hedonic qualities and appeal. Based on the observation and interview data, journalists were more positive than photographers towards the mobile system. On the individual level, there are, however, large differences in users' perceptions and overall judgments.

4.2 Description of the Attrak-Work questionnaire

As described in Section 2, we chose Hassenzahl's model as the starting point in the development of the questionnaire. We first created a model from our findings and earlier theories for the questionnaire development. The created model is presented in Figure 3, and it presents two groups of user perceptions of product characteristics, that is, the perceptions of pragmatic and hedonic qualities. Mahlke [11] refers to these as components of user experience and uses the terms utilitarian and non-utilitarian instead of pragmatic and hedonic. In our model, the user's perceptions of the pragmatic and hedonic qualities affect the overall judgment of the system, which in the Attrak-Work questionnaire is measured as appeal [7].

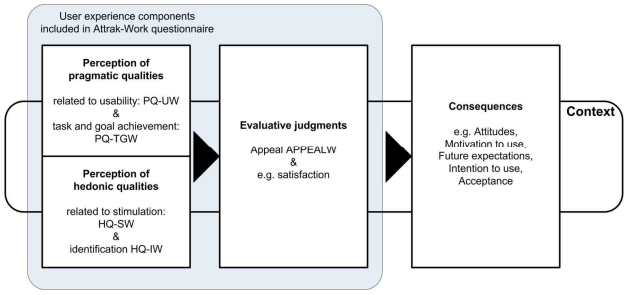

Figure 3. Model of user experience components in the development of the Attrak-Work questionnaire.

The evaluative judgments of the system are separated from the other consequences since judgments are related to the used system directly. As discussed earlier, in our view the perceptions of the pragmatic and hedonic qualities, the

evaluative judgments of the system as well as the other consequences are context-dependent and relative to the usage situations. Contextual dimensions [22], their elements and the actual usage situation affect the user's perception of the pragmatic and hedonic qualities and his or her overall evaluation of the used system.

The pragmatic attribute group in our elaborated questionnaire covers usability, and the hedonic attribute groups cover stimulation and identification. We also included a second group of pragmatic attributes related to task and goal achievement, since this is an important aspect affecting the user's judgment when the system is used as a work tool. Appeal was included as a fifth theme for assessing an overall evaluative judgment of the studied mobile system. We selected the Semantic Differential scale for assessing a rating for attributes. Each of the attribute groups contain seven or eight pairs of words or short statements (items) presenting opposites of qualities on a bipolar scale. We used a five anchor scale for the rating of the items, ranging from -2 to 2 when we implemented the questionnaire as part of the online survey.

It should be noted that the presented model is not intended to be a comprehensive model of user experience including all the aspects related to the phenomenon. It is a simplified model including components we used in the Attrak-Work questionnaire for measuring components of user experience. We did not for example include emotions in this model, although they could be included. However, the model presented in Figure 3 includes examples of themes related to the consequences of user experience that were found in our study and that have also been discussed in earlier literature.

In the following sub-sections we describe each attribute group in the Attrak-Work questionnaire. All attribute groups have been modified based on our findings from the observation and interview data. They therefore differ from the original items presented in AttrakDiff questionnaires, but also some of the original items are directly included in the Attrak-Work questionnaire. The items were created based on our findings, and they reflect how participants talked about the system and how they described its usage.

4.2.1 Pragmatic quality – Usability (PQ-UW)

As a basis for the users' assessment of the pragmatic quality of the mobile journalism system we used the attribute group used in AttrakDiff questionnaires [6], [7]. There are altogether seven items in this group, of which two are directly from the original AttrakDiff (PQ-UW-1=PQ_2, PQ-UW-4=PQ_6). In addition, two items are related but not completely identical to the items in AttrakDiff (PQ-UW-2~PQ_7, PQ-UW-3~PQ_4). The selected items, modifications and new items reflect the findings from the qualitative data. For example, a new item on reliability was included, since reliability was strongly emphasized by the participants as one basic usability-related aspect that was essentially important in the work context.

PQ-UW-1 Monimutkainen-Yksinkertainen, *Complicated-Simple*

PQ-UW-2 Vaikea-Helppo, *Difficult-Easy*

PQ-UW-3 Hankala-Vaivaton, *Challenging-Effortless*

PQ-UW-4 Hämmentävä-Selkeä, *Confusing-Clear*

PQ-UW-5 Epälooginen-Looginen, *Illogical-Logical*

PQ-UW-6 Epäluotettava-Luotettava, *Unreliable-Reliable*

PQ-UW-7 Arvailua vaativa-Intuitiivinen, *Needs guessing-Intuitive*

4.2.2 Task and goal achievement (PQ-TGW)

We created a separate attribute group related to task and goal achievement, since this is an important aspect affecting the appraisal of the system in the work context. Whereas the first pragmatic attribute group is related to usability, this second pragmatic attribute group concentrates on the effect and support of the product or system on working. The items in this group were created based on the themes that were found in the qualitative data.

PQ-TGW-1 Työskentelyä hankaloittava-työskentelyä helpottava, *Makes work harder-makes work easier*

PQ-TGW-2 Tehoton-Tehokas, *Inefficient-Efficient*

PQ-TGW-3 Kompromisseihin pakottava- Tavoitteita tukeva, *Forces compromise-Supports goals*

PQ-TGW-4 Hidastaa julkaisua kentältä-Nopeuttaa julkaisua kentältä, *Speeds up publishing from the field-Slows down publishing from the field*

PQ-TGW-5 Laatua alentava-Laatua edistävä, *Lowers quality-Enhances quality*

PQ-TGW-6 Työprosessia estävä- Työprosessia tukeva, *Obstructs the workflow-Supports the workflow*

PQ-TGW-7 Työskentelyä hidastava-Työskentelyä nopeuttava, *Speeds up work-Slows down work*

4.2.3 Hedonic quality – Stimulation (HQ-SW)

For assessing stimulation as an aspect of the hedonic quality of the system, we used the presented model as the starting point for developing the items. In our study, participants described several different types of stimulation-related aspects, as described in Section 4.1 that seemed relevant to be assessed with a questionnaire. However, these themes were not covered in the AttrakDiff 2 questionnaire, and we therefore redesigned the items to fit the context of the study. The seven created items are presented in the following:

HQ-SW-1 Kahlitseva-Inspiroiva, *Restricting-Inspiring*

HQ-SW-2 Turhauttava-Innostava, *Frustrating-Exciting*

HQ-SW-3 Lannistava-Motivoiva, *Discouraging-Motivating*

HQ-SW-4 Oppimista estävä-Oppimista stimuloiva, *Stimulates learning-Prevents learning*

HQ-SW-5 Luovuutta rajoittava-Luovuuden mahdollistava, *Limits creativity-Enables creativity*

HQ-SW-6 Kehittymistä rajoittava- Haasteita tarjoava, *Restricts development-Offers challenges*

HQ-SW-7 Ammatillista kunnianhimoa rajoittava-Ammatillisen kunnianhimon mahdollistava, *Constricts professional ambition- Enables professional ambition*

4.2.4 Hedonic quality – Identification (HQ-IW)

Similarly to the case of stimulation, we used the presented model as a theoretical background when developing the items for identification as the second group of hedonic quality. During the study, participants expressed various issues related to this theme. One item is identical to an item in the AttrakDiff2 questionnaire (HQ-IW-1=HQI-3). The other items

have been created based on the themes found in the qualitative data.

HQ-IW-1 Harrastelijamainen-Professionaalinen, *Professional-Amateurish*

HQ-IW-2 Epäuskottava-Uskottava, *Unconvincing-Credible*

HQ-IW-3 Luottamusta vähentävä-Luottamusta herättävä, *Raises trust-Lowers trust*

HQ-IW-4 Haastateltavia tai kuvattavia epäilyttävä-Haastateltavalle tai kuvattavalle kynnystä alentava, *Increases suspicion in interviewees-Lowers the threshold of interviewees*

HQ-IW-5 Ammatillista imagoa laskeva-Ammatillista imagoa kohottava,
Lowers professional image-Promotes professional image

HQ-IW-6 Ammattilaisten silmissä väheksyttävä-Ammattilaisten silmissä arvostettu,
Undervalued by professionals-Valued by professionals

HQ-IW-7 Vähentää työn arvostusta-Lisää työn arvostusta, *Lowers respect for the work-Enhances respect for the work*

4.2.5 Appeal

Attribute group APPEALW in the Attrak-Work questionnaire comprises of aspects discussed by the participants that were related to the overall appeal of the system. Appeal is included also in the AttrakDiff questionnaire (2000), comprising of eight items. We included three of these items in the Attrak-Work questionnaire (APPEALW-1=APPEAL1, APPEALW-3=APPEAL2, APPEALW-4=APPEAL5). In addition, we included from the group of pragmatic quality in the AttrakDiff2 questionnaire the item of practicality PQ_3 (APPEALW-8), since in our view this is more an overall evaluation related to appeal. The other new items reflect the findings in the field study data as well. The eight items are as follows:

APPEALW-1 Epämieluisa-Mieluisa, *Unpleasant-Pleasant*

APPEALW-2 Yhdentekevä-Tärkeä, *Insignificant-Important*

APPEALW-3 Huono-Hyvä, *Bad-Good*

APPEALW-4 Vastenmielinen-Houkutteleva, *Unattractive- Attractive*

APPEALW-5 Vakava-Rento, *Serious-Relaxed*

APPEALW-6 Tylsä-Kiinnostava, *Dull-Interesting*

APPEALW-7 Hyödytön Hyödyllinen, *Useless- Useful*

APPEALW-8 Epäkäytännöllinen-Käytännöllinen, *Impractical-Practical*

4.3 Issues on developing and administering the Attrak-Work questionnaire

The questionnaire was pre-tested by one researcher at two occasions during the questionnaire development. She was involved in the collection and analysis of the qualitative data, but she was not involved in the development of the questionnaire items. She was asked to point out items that were not clear, if they were not reflecting the findings, if the anchors for an item were not appropriate or if there were duplicates. The final questionnaire was pre-tested similarly by two other researchers, who were not involved in the study. Due to the tight schedule of the ongoing field study, which involved data collection, transcribing and analysis before creating the items for the Attrak-Work questionnaire, we were not able to involve outsiders, such as the participants of the study, or other professionals working in news journalism in the pre-testing.

For the questionnaire scale we selected the Semantic Differential Scale for assessing the participants' ratings on the items (attributes). We used in this study a five-point scale ranging from -2 to 2. The Semantic Differential Scale is known to be sensitive to selection of the anchors. Selecting a "wrong" pair has an effect on the responses and the reliability of the results. As described earlier, by pretesting we aimed to find these problems. However, we consider developing a second version of the questionnaire, which uses a Likert-scale instead of the semantic differential scale. Regarding the administration of the questionnaire as an online survey, each group of attributes was evaluated separately in the order presented in Section 4.2. In the future studies we will group the pragmatic qualities into one group and mix the items, and do the same for the hedonic items as well.

5. EXEMPLARY RESULTS FROM ATTRAK-WORK QUESTIONNAIRE

In this section, we present and discuss an example of the results when the Attrak-Work questionnaire was used within our study. Our findings from the qualitative data indicate clearly, that the photographers perceived the mobile system more negatively than the journalists especially regarding the hedonic qualities. We were therefore interested in whether we could find a statistically significant difference in the perceptions of the pragmatic and hedonic qualities and overall judgment between the user groups by using the responses collected with the Attrak-Work questionnaire. However, we want to stress, that even if we cannot find a statistically significant evidence for an emerging theme or finding in the qualitative data, it does not mean that it is not important or it does not exist in real-life. Care must therefore be taken when interpreting the results and not to overweight the meaning of the questionnaire results in comparison to the qualitative data, which in this case study has the main emphasis.

For getting an overall evaluation of the mobile journalism system, we used the five attribute groups (PQ-UW, PQ-TGW, HQ-SW, HQ-IW, APPEALW) as scales. First, to gain a scale value for the perceived qualities and appeal for each respondent, we calculated the mean of the ratings for items (attributes) within an attribute group. We then tested the internal consistency reliability of the scales with Cronbach's alpha for all five attribute groups. We selected the items for the scales based on the corrected item-total correlation values ($\geq$0.3) and Cronbach's alpha value (>0.7). The scales PQ-TGW (α = 0.886), HQ-SW (α = 0.870), and HQ-IW = (0.845) include the seven original items presented in the previous section. For scale PQ-UW we removed two of the original seven items, that is, PQ-UW-3 and PQ-UW-6 (α = 0.809). In addition, for scale APPEALW we removed two of the eight original items, that is, APPEALW-2 and APPEALW-6 (α = 0.819). We then recalculated the scale values.

To test if there is a statistically significant difference between the perceptions of the journalists and photographers on the perceived qualities and appeal we used the non-parametric Mann-Whitney U test. We first calculated the arithmetic mean of the scale values for both user groups. We then calculated the Mann-Whitney U test using the professional role (user group) as a grouping variable. The results of the significance test for each scale are shown in Table 1. The results show that for

perceived hedonic quality of identification (HQ-IW), we found statistically significant difference between the user groups ($U=8.5$, $p<0.05$). For perceived pragmatic qualities PQ-UW and PQ-TGW as well as for overall judgment APPEALW, we did not find statistically significant difference. For perceived hedonic quality of stimulation HQ-SW ($U=11.5$, $p<0.1$), we found a trend, but it cannot be interpreted in strict statistical sense showing significance.

Table 1. Results of the Mann-Whitney U test for scales with professional role as a grouping variable.

	PQ-UW	PQ-TGW	HQ-SW	HQ-IW	APPEALW
Mann-Whitney U	22.0	18.0	11.5	8.5	13.5
Exact. Sig.	.536[a]	.281[a]	.054[a]	.021[a]	.189[a]

a. [2*(1-tailed Sig.)], not corrected for ties.

6. DISCUSSION

Developing a questionnaire is tricky. Phases of the development include for example selecting or developing a framework or theory or using earlier findings as the basis for development, operationalizing the chosen theory and concepts, preparing the questions, selecting an appropriate scale and pretesting the questionnaire. In addition, when developing a questionnaire one has to consider carefully the goal of the development and consider the context it is intended for.

The primary goal of the questionnaire development in our study was to develop a practical tool for assessment of user experience in a work context, specifically in mobile news journalism. We developed the questionnaire to corroborate and expand the findings from observation and interview data in a field study. In addition we aimed to develop a tool for our future evaluations of mobile systems in the context of mobile news journalism. In the field study graduate level students of journalism and visual journalism used a multipart mobile system during two project days to publish an online publication directly from the field. The system consisted of a mobile multimedia phone, a wireless Bluetooth keyboard and a mobile application developed for creating stories and submitting or publishing them directly.

When developing the Attrak-Work questionnaire, we used Hassenzahl's model of user experience (see Figure 1, [5]) as a guiding theory in the analysis of the observation and interview data, but also looked for other related themes. Based on the findings we refined Hassenzahl's model by including task and goal achievement as a second attribute group for the assessment of the pragmatic qualities. The created model (see Figure 3) separates the evaluative judgments of the product, such as appeal and satisfaction from the other consequences, such as acceptance, motivation to use and intension to use. The findings from the qualitative data were used in the development of the items for the five groups of attributes, that is, for 1) pragmatic quality – usability PQ-UW, 2) pragmatic quality – task and goal achievement PQ-TGW, 3) hedonic quality – stimulation HQ-SW, 4) hedonic quality – identification HQ-IW and 5) for overall judgment of appeal APPEALW.

The developed Attrak-Work questionnaire was used at the end of the field study to assess the perceived pragmatic and hedonic qualities and the overall judgment of appeal of the used mobile journalism system. Attrak-Work questionnaire was administered as part of an online survey targeted to the participants of the field study. The qualitative data shows a clear difference in the perceptions of the hedonic qualities related to stimulation and identification as well as appeal between the photographers and journalists in the study. As an exemplary result for using of the developed Attrak-Work questionnaire we found statistically significant difference for the hedonic quality identification HQ-IW ($U=8.5$, $p<0.05$).

We found the Attrak-Work questionnaire to be a useful tool in an exploratory study of user experience for several reasons. First, since it is often not possible in a field study to observe or even interview all the participants, it provides a way of accessing the perceptions of a wider set of participants. Second, using a questionnaire means that all the respondents answer the same questions, and therefore we are able to get views on each item from all respondents. Therefore, themes that may not come up in the majority of observations or interviews can still be included to the study. However, one improvement related to this could be to ask the respondents to weight or order the importance of the attributes to find out how important the less discussed themes are compared to the ones that are discussed more. Third, we can use the tool in our further studies in the same field and also for example compare results from different case studies with different participants.

There are several limitations in the development and testing of the questionnaire. Pre-testing was done with researchers, since the study was fast-paced and there was no time to involve outsiders into the development process. The use of an expert panel consisting of outsiders who preferably work as photographers and journalists would give feedback on the wording of the items and help in finding the correct anchors for each item therefore improving the validity of the items. In addition, using external experts working in news journalism would give feedback from a wider audience and improve the validity of items. A recommendable way of obtaining feedback would also be to involve the participants of the study to comment the questionnaire, its themes and individual items after filling it.

Another issue that can be seen as a limitation to the validity of the questionnaire is that the items (attributes) in the Attrak-Work questionnaire were created based on the findings from the observation and interview data. They therefore reflect this particular case study and the subjective views of its participants on the mobile journalism system and its usage. However, similar themes and attributes have arisen in our other case studies, with differences in the emphasis of themes depending on the group of participants and their backgrounds. We therefore believe, that for the context of mobile news journalism, the created questionnaire reflects well especially the hedonic aspects related to the mobile system use.

Although the current version of the Attrak-Work questionnaire is context specific especially regarding the attributes for hedonic quality identification, the themes included that are reflected by the individual items can be used as guidance when generalizing or targeting the questionnaire to another field of mobile work. Furthermore, the questionnaire can be applied to also any other type of mobile work tool in the context of journalism, be it a systems camera, laptop, audio recorder, or even pen and paper.

As a conclusion, we found the questionnaire to support our goal of corroborating and expanding the findings of the qualitative data and especially useful for capturing the perceptions of the hedonic qualities. In the future studies we are considering choosing one of the validated usability questionnaires to assess an evaluation of the pragmatic qualities either as a reference for attribute groups in Attrak-Work. In addition, we will carefully analyze the attribute group for appeal to identify possible needs for changes.

7. ACKNOWLEDGMENTS

We thank Tero Jokela for his valuable contribution to the study and Piia Nurkka for her comments on the article. This work has been supported by the PALTI project (2007-2009) funded by the Ministry of Education, Finland.

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Paper 4

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User Experience of Smart Phones in Mobile Journalism – Early Findings on Influence of Professional Role

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ABSTRACT
We used an online questionnaire in the end of a case study to explore whether and how professional role – the role of a news journalist or a news photographer – affects user experience of smart phones used for mobile news making. Fifteen participants assessed the pragmatic and hedonic qualities and an overall judgment of appeal of a smart phone based mobile journalism system. We found that photographers assessed the hedonic quality identification more negatively than journalists and a similar trend was found for hedonic quality stimulation. We did not find a statistically significant difference between the user groups for the perception of pragmatic qualities or overall judgment of appeal.

Author Keywords
User experience, work, journalism, smart phone.

ACM Classification Keywords
H5.2. User Interfaces: Evaluation/methodology.

INTRODUCTION
Smart phones with multimedia capabilities are an alternative tool for news photographers and journalists for mobile news making and reporting. In addition to usability, different contextual and personal goals and needs related to profession may affect the users' experiences and therefore their perceptions of the smart phone qualities (Väätäjä, in press).

User experience is often defined as a result of the user's interaction with the system in a particular context. Features of the user, system and context affect the characteristics of the interaction (e.g. Mahlke et al., 2007). According to Hassenzahl (2003) and Mahlke et al. (2007) the characteristics of the interaction are perceived as qualities of the system. These perceived qualities can be categorized into two distinct sets, pragmatic, instrumental, and hedonic, non-instrumental qualities. Hassenzahl (2008) further discusses that pragmatic and hedonic quality refer respectively to a system's perceived ability to support do-goals and be-goals (Carver et al. 1998). Examples of do-goals are taking a photo or writing text with a smart phone, whereas examples of be-goals are being competent and stimulated (Hassenzahl 2008, Hassenzahl et al. 2010). Hassenzahl (2008) argues, that "the fulfilment of be-goals is the ultimate source of positive experiences" and that the role of usability is to facilitate the pursuit of be-goals. Furthermore, in their study on users' positive experiences with interactive products, Hassenzahl et al. (2010) show that fulfilment of universal psychological needs, such as competence, popularity and relatedness, is linked to hedonic quality perceptions and evaluation of goodness.

Only a few studies in the field of HCI report on the assessment of user experience of work related systems (Isleifsdottir et al. 2008, Schrepp et al. 2006). In the field of information systems (IS) research studies report on hedonic aspects of mobile service use (e.g. Van der Heijden et al., 2003) and focus for example on fun and pleasure. Our research is based on the approach of assessment of quality perceptions by Hassenzahl (2003).

The goal of this paper is to explore whether and how professional role is linked to the quality perceptions and judgment of appeal of smart phones in mobile news making. We administered an online questionnaire in the end of a case study in which smart phones were used for mobile news making. In the questionnaire the participants were asked to assess the pragmatic and hedonic qualities and appeal of the used mobile journalism system with the Attrak-Work questionnaire (Väätäjä et al., 2009). We first describe the methodology used for the assessment of the perceived system qualities, and the present the results.

METHODS
We used case study approach (Yin, 2003) in our study with multiple data collection methods. In this paper we report assessed quality perceptions and judgment of appeal measured with the Attrak-Work questionnaire. Questionnaire was developed within our study based on the theoretical framework presented by Hassenzahl (2003) and on the findings from the earlier phases of the study. Development of the questionnaire along with its items is described in detail in (Väätäjä et al., 2009) with brief results. This paper focuses on presenting and discussing the results of the questionnaire in more detail.

Participants. The case study had nineteen participants who took part in an M.A. level university course on web publishing. Fifteen of the participants responded on voluntary basis to the post-usage questionnaire in the end of the study. Eight respondents were students of journalism (journalists from now on) and seven were students of visual journalism (photographers from now on). All respondents had practical working experience in the field of journalism (journalists: min=1yr, max=18yrs, mean=4.0yrs; photographers: min=2yrs, max=5yrs, mean=3.0yrs). Respondents were compensated with a movie ticket (8 €).

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Mobile journalism system. Participants used a mobile journalism system consisting of a smart phone with multimedia capabilities to capture photos and video clips (Nokia N82, with a 5 megapixel camera with Carl Zeiss optics), a wireless Bluetooth keyboard for writing text (Nokia SU-8W) and a mature prototype of a mobile journalism application, which enabled writing and editing of articles and submission of all journalistic material from mobile context. System was used for reporting news on the university life to a web publication on two project days (see e.g. Väätäjä et al. 2009).

Procedure. Post-usage questionnaire was administered in the end of the study. All participants were contacted with an email with a link to the online questionnaire and asked to reply within ten days after the last project day. One reminder was sent by email two days before the deadline. Attrak-Work questionnaire (Väätäjä et al. 2009), which measures the pragmatic and hedonic qualities and appeal, was part of the online questionnaire, starting at the second question. Participants were asked to evaluate the mobile journalism system with all its parts (phone, external keyboard and application) as an entity.

The five Attrak-Work subscales include two attribute groups for pragmatic qualities (Usability PQ-UW; Task and Goal Achievement PQ-TGW), two attribute groups for hedonic qualities (Stimulation HQ-SW; Identification HQ-IW) and one group for appeal (APPEALW). Each subscale has seven items, except the subscale on appeal, which has eight items (Väätäjä et al. 2009). A five-point Semantic Differential scale, from -2 to 2, was used with attributes at both ends of the scale as anchors. Original items of the questionnaire are in Finnish. For publication purposes, items were translated to English and checked with back translation.

Analysis. Questionnaire data was analyzed with SPSS software using non-parametric methods. User group (professional role) was used as a grouping variable.

RESULTS

In this section we present and discuss the results focusing on the differences found based on the professional roles, that is, the role of a news journalist and photographer. We examined the data in two ways. First, we present results for the five attribute groups, i.e., subscales. Second, we discuss separately the individual items. It should be noted, that the level of significance at $p<0.1$ in results cannot be seen as statistically reliable, but showing trend.

Results based on subscale values

We first used the five attribute groups as subscales to gain an overview of the similarities and differences in the evaluations between user groups as described in Väätäjä et al. (2009). First, we calculated the mean of the ratings for items within each subscale for each respondent following Hassenzhal's approach (2004). Second, we tested the internal consistency reliability of the subscales with Cronbach's alpha. Third, we selected the items for calculating the value for each subscale based on the corrected item-total correlation values (≥ 0.3) and with Cronbach's alpha value ($\alpha > 0.7$).

	PQ-UW	PQ-TGW	HQ-SW	HQ-IW	APPEALW
Included items	1,2,4,5,7	1-7	1-7	1-7	1,3,4,5,7,8
Cronbach's alpha	0.809	0.886	0.870	0.845	0.819
Mann-Whitney U	22.0	18.0	11.5	8.5	13.5
Exact. Sig.	.536[a]	.281[a]	.054[a]	.021[a]	.189[a]

a. [2*(1-tailed Sig.)], not corrected for ties.

Table 1. Cronbach's alpha and Mann-Whitney U test with professional role (user group) as a grouping variable.

Table 1 presents the included items for calculation of the mean value of the subscale along and the Cronbach's alpha value for each subscale after pooling. In addition, results of the Mann-Whitney U test on the mean of the pooled items are presented. Professional role was used as a grouping variable. A significant difference between the user groups was found for the perceived hedonic quality identification (HQ-IW). For hedonic quality stimulation (HQ-SW) a trend was found. No significant difference was found for the three remaining subscales.

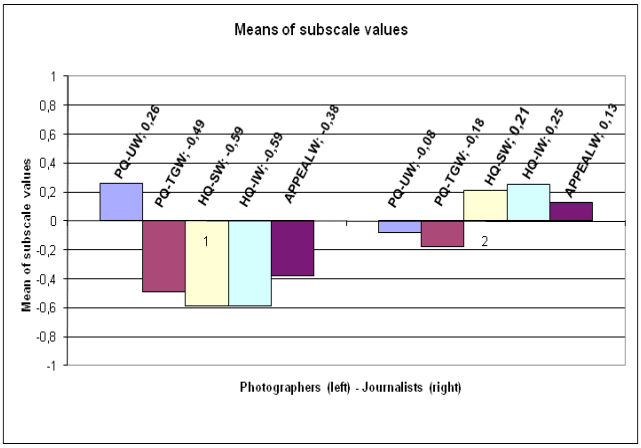

Figure 1. Means of subscale values for photographers (on the left, $n_1=7$) and for journalists (on the right, $n_2=8$).

Figure 1 illustrates the means of the subscale values based on the professional role. As can be seen from Figure 1, the photographers' perceptions of both hedonic qualities are negative, whereas the journalists' assessment is slightly positive, but close to neutral. This result supports our findings from the observation and interview data (Väätäjä, in press), that photographers found it harder to identify with smart phones than journalists (see also Figure 2). In addition, result supports our earlier findings that photographers in this study found the usage of the mobile journalism system less stimulating than journalists. All in all, the journalists were more neutral in their attitude and perceptions, seeing the technology primarily as a means to get their job done, whatever the used technology is (see also Väätäjä, in press). However, the perceptions differ considerably within the user groups depending on the person in question as exemplified in Figure 2 for hedonic quality HQ-IW.

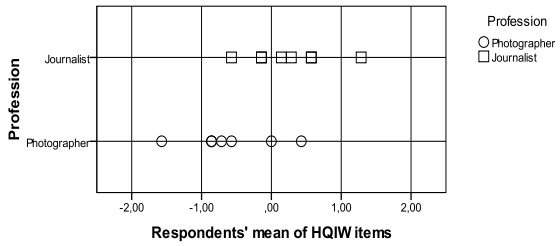

Figure 2. Mean values for hedonic quality identification HQ-IW for photographers (n_1=7) and journalists (n_2=8).

Differences based on individual scale items

The averaging approach, that is, calculating the arithmetic mean of pooled subscale items, is insensitive to individual attributes. Since we wanted to examine the differences between the user groups in more detail, we were interested in individual items (attribute pairs) as well. To test for the difference in perceptions of the individual items we used the Mann-Whitney U test.

Table 2 presents an overview of the items showing difference between the user groups based on significance level. In both groups of hedonic attributes two items show a significant difference ($p<0.05$) and one item shows a trend ($p<0.1$). For the items in attribute group for appeal, evaluation of one item shows a significant difference between user groups ($p<0.01$) and two items show a trend ($p<0.1$). It is worth noting at this point, that two of the items (APPEALW-2 and APPEALW-6) showing a difference were not included in the previous section for calculating the mean value for the subscale on appeal. No significant difference was found for individual items in either of the pragmatic attribute groups.

Exact sig.	PQ-UW	PQ-TGW	HQ-SW	HQ-IW	APPEALW
$p<0.01$ [a]	na	na	na	na	item 6
$p<0.05$ [a]	na	na	items 5 & 7	items 2 & 6	na
$p<0.1$ [a]	na	na	item 4	item 5	items 1 & 2
Nr of items	7	7	7	7	8

a. [2*(1-tailed Sig.)], not corrected for ties.

Table 2. Items showing difference between user groups based on significance levels (Mann-Whitney U).

HQ-SW-5 Limits creativity - Enables creativity
HQ-SW-7 Constricts professional ambition – Enables professional ambition
HQ-SW-4 Prevents learning – Stimulates learning
HQ-IW-2 Unconvincing – Credible
HQ-IW-6 Undervalued by professionals – Valued by professionals
HQ-IW-5 Lowers professional image – Promotes professional image
APPEALW-6 Dull – Interesting
APPEALW-1 Unpleasant – Pleasant
APPEALW-2 Insignificant - Important

Figure 3 presents as frequencies the ratings for hedonic stimulation item HQSW-5: *Limits Creativity-Enables Creativity* (n_1=7, n_2=8, U=8.5, $p<0.05$). As we can see, photographers evaluated the mobile system to limit their creativity, whereas journalists' ratings are more distributed. The observation and interview data reveal several reasons for the negative evaluation by photographers. These include for example the insufficient adjustments for photographing mentioned by the photographers, which some of them described to limit their creative expression (see e.g. Väätäjä, in press).

Figure 4 presents the ratings of the hedonic stimulation item HQSW-7 *Constricts professional ambition-Enables professional ambition* (n_1=7, n_2=8, U=10.5, $p<0.05$). Photographers evaluated this item more negatively than journalists, whereas the evaluations by journalists are again more dispersed. For example, based on the observations and interviews, the journalist who assessed this most positively was clearly the most enthusiastic about the new possibilities enabled by the system. On the contrary, the photographers who rated this item most negatively, were most ambitious based on the interviews.

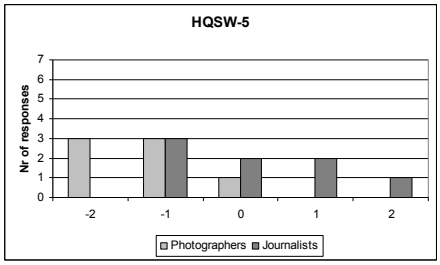

Figure 3. Ratings of item HQ-SW-5 *Limits Creativity-Enables Creativity* by photographers (n_1=7) and journalists (n_2=8) (U=8.5, p<0.05).

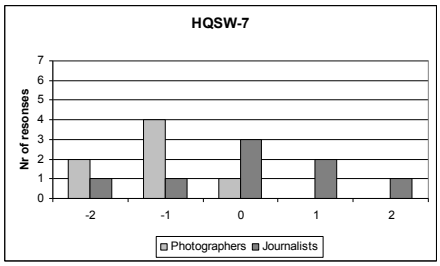

Figure 4. Ratings of item HQ-SW-7 *Constricts professional ambition-Enables professional ambition* (n_1=7, n_2=8, U=10.5, p<0.05).

We next look items related on hedonic identification. Figure 5 presents the distribution of the ratings for the item HQIW-2 *Unconvincing-Credible* (n_1=7, n_2=8, U=10.5, $p<0.05$). This item is based on the comments made by the photographers on the credibility, or, on the contrary, the unconvincingness of the mobile phone as a tool of a professional as seen by externals, such as their interviewees or professionals from other media organizations. Photographers in this study rated the mobile system as more unconvincing than the journalists.

The ratings of the item HQIW-6 *Undervalued by professionals-Valued by professionals* (n_1=7, n_2=8, U=8.5, $p<0.05$) are presented in Figure 6. This attribute pair aims to reflect how the system is valued in the eyes of professionals. Photographers assessed this item clearly negatively, whereas journalists were more neutral.

Figure 7 presents the ratings of the item APPEALW-6 *Dull-Interesting* (n_1=7, n_2=8, U=6.5, $p<0.01$). Interview data, both before and after usage, indicated that journalists find the mobile system more interesting than

the photographers. This is confirmed by the ratings of this attribute pair.

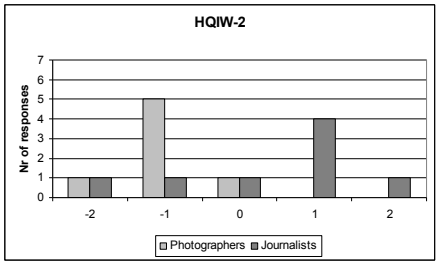

Figure 5. Ratings of item HQ-IW-2 *Unconvincing-Credible* (n_1=7, n_2=8, U=10.5, p<0.05).

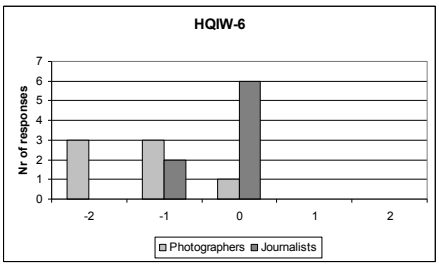

Figure 6. Ratings of item HQ-IW-6 *Undervalued by professionals-Valued by professionals* (n_1=7, n_2=8, U=8.5, p<0.05).

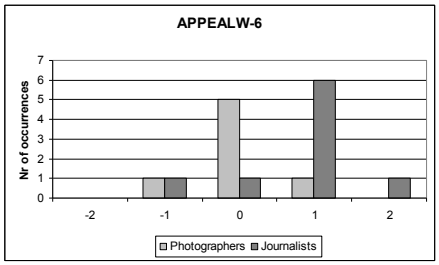

Figure 7. Ratings of item HQ-IW-6 *Dull-Interesting* (n_1=7, n_2=8, U=6.5, p<0.01).

DISCUSSION AND CONCLUSIONS

We found a statistically significant difference between journalists and photographers in the perception of the hedonic quality identification. In addition, we found a trend for hedonic quality stimulation. In both cases, the photographers assessed these qualities more negatively than journalists. Similarly for individual attributes (items), we found that when a statistically significant difference was found, the photographers were more negative in their ratings than the journalists.

Overall, the presented results corroborate our earlier findings from interview and observation data (Väätäjä, in press) that there exist differences in be-goals and needs based on professional role. These are likely to have an influence on the user experience as well as on hedonic quality perceptions of the used technology. In addition, since a questionnaire explicitly provides responses for the same ratings from all respondents, many of the themes that emerged only in some interviews or observations, were corroborated by the questionnaire results.

There are several limitations in the study. First, the Attrak-Work questionnaire was developed based on the findings from earlier phases of the same study, which may affect the validity and reliability, and generalizability especially in another setting. A more rigorous validation of the questionnaire should be conducted in the future. Second, the number of respondents is low as well as the context in the university course setting lacks realism in real-life context. The results presented are therefore initial, and they reflect the respondents' subjective perceptions and judgment of the used system. The future work should study in realistic context a larger sample of users evaluating a variety of smart phones and applications from different manufacturers.

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Paper 5

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Bottlenecks, Usability Issues and Development Needs in Creating and Delivering News Videos with Smart Phones

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ABSTRACT

We conducted five user studies on using smart phones with multimedia capabilities for creating and delivering news content. We present here findings on bottlenecks, usability issues and development needs related to mobile news video capture, editing and uplink delivery. The identified bottlenecks for fast and reliable news video publishing are the uplink delivery of videos from mobile context due to the network limitations and throughput of the mobile system. To enhance the technical quality of the created videos, participants wished for high quality lenses, optical zoom, manual adjustments and a possibility to use an external microphone for audio recording. In addition, the form factor of the device should support the capturing by providing a firm grip and enabling moving of the display. For video editing, more functionalities were wished for, which sets a challenge to designing for small screen devices. Furthermore, the battery life-time was found to be too short especially for video editing. Implications for design and development are presented based on the practical development needs and challenges related to the usage of smart phones for news video capture, editing and uplink delivery.

Categories and Subject Descriptors

H.5.m [**Information Systems**]: *Miscellaneous*

General Terms

Design, Human Factors, Performance, Reliability.

Keywords

Camera phone, video, capture, editing, delivery, uplink, usability.

1. INTRODUCTION

The recording eye of a camera phone is nowadays present everywhere. Smart phones equipped with multimedia features have shown their usefulness as eyewitness tool in reporting major news events, such as accidents, catastrophes and natural disasters. An increasing number of news media is incorporating reader reporters into their news creation processes and utilizing multimedia material created by reader reporters as news content, such as CNN[1] and CBS[2]. Furthermore, some news agencies, like Reuters[3] and Adresseavisen in Norway, have experimented or adopted smart phones as tools of professionals for news making.

To exemplify the number of consumed video content, forecasts such as the one presented by Cisco [1] show an exponential growth for near future. Globally, mobile data traffic will double every year through 2014, increasing 39 times between 2009 and 2014. Mobile data traffic will grow at a compound annual growth rate (CAGR) of 108 percent between 2009 and 2014, reaching 3.6 exabytes per month by 2014. Almost 66 percent of the world's mobile data traffic will be video by 2014. Mobile video has thus the highest growth rate of any application category. Some estimations claim that currently nearly 80 % of all Internet users view video on a regular basis worldwide[4]. During 2009 and early 2010 the growth has been significant, especially with the online video streams of Web media brands (yearly growth 165 %), Magazine publishers (yearly nearly 100%) and Broadcast Networks (yearly growth 74 %)[8]. However, newspaper sites still have the hardest time getting viewers to their videos [8].

There exist only a few earlier studies in the field of HCI, which report on using smart phones for news video capture, editing and/or delivery. One of the first is reported by Hickey et al. [2] on using Nokia 7710 smartphone (QCIF, 17 fps). The quality of the created videos was not found sufficient for publishing the videos in an online publication, but some participants anticipated that mobile video could be useful for journalism in ad-hoc situations. Similarly, Jokela et al. [5] report, that participants considered mobile multimedia phones useful for shooting videos for online publications. According to Jokela et al., the needed improvements are manual adjustments of camera parameters, a more sensitive sensor, higher image resolution and faster focusing and shooting. In addition, new flexible display technologies or larger external displays are suggested to help the editing and previewing of images. Further, Koponen et al. [6] report that professionals find using of smart phones justified for authentic news reporting in hectic news situations, when the quality plays a minor role. Especially the audio quality of video clips was criticized. In

MoViD'10, October 25, 2010, Firenze, Italy.

[1] http://www.ireport.com/

[2] http://techcrunch.com/2008/09/22/cbs-launches-eyemobile-for-iphone-to-target-citizen-journalists/

[3] http://www.nokia. com/press/pressreleases/showpressrelease?newsid=1161557

[4] Christophor Rick, "80% Of Internet Users Watch Online Video, Worldwide", (http://www.reelseo.com/80-internet-users-watch-online-video-worldwide/)

addition, the battery life-time in editing was found short and the mobile delivery being slow and unreliable.

A number of user studies report usage of smart phones for multimedia capture by consumers e.g. [3], whereas relatively few report on mobile video editing e.g [4]. Our work contributes by identifying development needs for video capture, editing and delivery, in the context of news reporting, where the users are mobile professionals, such as news journalists and photographers. Our results confirm and extend the results from earlier reported studies in the same context. Results are useful also as indicators of development needs for consumer markets.

This paper reports the challenges and development needs related to using smart phones for capturing, editing and delivering news videos in real contexts of use. We conducted four field studies and one interview study to collect users' experiences, perceptions on the quality of the created news content as well as development needs. In this paper we focus on the findings related to news videos. We first describe the recent technological development of the capabilities of smart phones as multimedia capturing devices. We then describe the case studies and their setting. Results are presented and discussed, concluding with implications for design and development as well as with suggestions for future work.

2. TECHNOLOGICAL DEVELOPMENT IN MOBILE MULTIMEDIA CAPTURING

When presenting the N-series in 2005 Nokia opened a new era for mobile phone industry. The N-series devices included high quality optics made by Carl Zeiss, which made these devices something to be reckoned with for the first time in the professional multimedia production. After the release of N-series several manufacturers (e.g. Sony-Ericsson and Samsung) have released product lines designed for high-end photographing.

In terms of optical performance some of the first flagship-models of Nokia N-series, N90 (spring 2005) and N93 (spring 2006) were targeted for making still-images – not for professional video-making. This stems from the rather small image sensors in terms of megapixels (N90 2 Mp and N93 3.2 Mp) and further because of the small physical size of the image sensor. As the sensor size in N93 was only 1/3.2" (= 4.5 x 3.4 mm with surface area 15,5 mm^2) and pixel size 2.2. micron it could not yet beat the consumer level digital cameras in image quality. In 2007 many compact cameras had standard 1/2.5" sensors with a surface area of 24.7 mm^2 (approx. 50 % larger than sensor in N93) while many DSLRs had sensor areas around 370 mm^2 [5].

In response to growing consumer demand for higher quality and more compact digital cameras in mobile phones, the pixels in CMOS image sensors have become smaller. Smaller pixels have worse light-gathering ability and more non-idealities. As a result, reducing pixel size and increasing pixel count while keeping the size of an imaging sensor array fixed, does not always yield a better image quality as shown by Tisse et al. [9]. In spite of the advances in CMOS pixel technology and design promised by the manufacturers of image sensors, it will become difficult to scale pixel size down to 1.45µm without significant degradation in image quality. Spatial resolution and light sensitivity are two fundamental characteristics of image sensor that must be considered for characterizing and optimizing image quality. These characteristics are generally obtained from the Modulation Transfer Function (MTF) and the system Signal-to-Noise-Ratio (SNR).

The release of Nokia N82-model in fall 2007 was a milestone for camera phones. It uses 5 megapixels CMOS image sensor, size 1/2.5" being equal to the sensors in consumer level digital cameras. In the following years 2008 and 2009 several other manufactures begun to release mobile phones with image sensor size 1/1.25" (e.g. Sony Ericsson Satio and Samsung Pixon 12).

In addition to increasing size of image sensor the advancing of the overall imaging performance of camera phones has been due to enhancements in optics, processor speeds and signal processing. General effect has been the considerable enhancement in low light performance which only few years ago was a critical issue in camera phones. With the increased overall performance in image quality (both still and video) high end mobile phones appeared by 2009 as a credible alternative for journalistic use. Next giant leap forward is the adoption of HD-quality mobile devices in the industry such as the 12-megapixel Nokia N8 in fall 2010. With wide-angle Carl Zeiss optics and the biggest sensor (1/1.83") in a mobile phone it will outperform many ordinary still and video cameras.

After reaching such a high level in image quality camera phones have passed maybe the worst obstacles in technology. From the perspective of professional photographers directing the product development to the usability issues and creating professional-level, camera-like features, enhanced editing possibilities and control systems to these devices would be desirable. In this work we present implications for development on some of these issues.

3. METHODS AND SETTING

We used case study approach [10] to conduct five user studies in Finland between February, 2008 and May, 2010. The studies are summarized in Table 1, and ordered time-wise, fifth being the latest. Four of the case studies are field studies on using smart phones for capturing, editing and delivering news content in realistic contexts. Case 2 is an interview study with professionals on their experiences on real-life usage. A more detailed description for case 1 can be found for example in [5] and for case 2 in [6]. Case 3 was the only study specifically concentrating on mobile news videos. All other studies included videos as one form of created news content with smart phones. In this paper we concentrate on the results from all of these studies that are related to capturing, editing or delivering of mobile news videos from mobile context.

Setting of the field studies. The four field studies were conducted with students of journalism and/or visual journalism (cases 1, 3, 4, 5) within their M.A. studies. In their course on web publishing, students' goal was to create, edit and deliver news content from the spot of the news event with smart phones and an application dedicated for mobile news content delivery. No tasks were assigned to the participants by the researchers. Instead, the students participated in the ideation of the topics within their course (cases 1, 4, 5) or carried out given assignments by the media organization (case 3). The created material was published in an online publications varying from a local newspapers' online version (case 3) to a blog (case 4) and online magazines created by the students (cases 1, 5).

[5] Vincent Bockaert, "Sensor Sizes" (http://www.dpreview.com) and Wikipedia: "Image sensor format".

Table 1. Case studies for creation of news content.

Case	Type of study	Nr of part.	Phone Model*	Enhanced video editor	Special app. for delivery
1	Field (o, i, q)	19	N82	No	Yes
2	Interviews	6	e.g. N93, N95	If in phone model	Various solutions
3	Field (o, i, q)	10	N82	Yes	Yes
4	Field (o, fc, q)	8	N82	Yes	Yes
5	Field (q)	8	N97, N900	No	Yes

*All phones are models of Nokia.
o = observation, i = interview, q = questionnaire, fc = focus group

Mobile devices and applications. Smart phones used in all field studies had a 5 megapixel sensor, Carl Zeiss optics, and enabled capturing video at VGA quality at 30 fps. Mobile applications used in the field studies (cases 1, 4, 5) for content delivery were research prototypes developed at Nokia Research Center, except in case 3, in which students used the application provided by the newspaper. The professionals interviewed in case 2 used various applications and methods of mobile delivery depending on the newspaper they were working for. In two field studies with Nokia N82 (cases 3, 4), a mobile video editor with enhanced properties for video editing was installed on the devices prior to the study, similar to the one pre-installed on Nokia N95 in sales package.

Data collection. In three field studies (cases 1, 3, 4) we collected hand-written field notes when observing participants' mobile system usage in the natural context. In field studies 1 and 3 we also conducted semi-structured interviews and in case 4 a focus group to collect data on users' experiences and perceptions on the strengths, weaknesses, feasibility and development needs as well as on satisfaction with the quality of the created material. In case 5 a post-usage questionnaire with closed and open-ended questions was used for data collection. Questionnaires were also used in all field studies to collect for example background data on the participants. In case 2, six professionals were interviewed about their experiences of using smart phones in news content creation and delivery.

Analysis. The hand-written notes from field observations and audio recordings of interviews were transcribed. The observation and interview data was analyzed by content analysis using open coding for emerging themes and grouping these under higher level categories [7]. The data on open-ended questions from questionnaire in case 5 was similarly analyzed by content analysis. Closed-ended questions of questionnaires were analyzed by non-parametric methods.

4. RESULTS

We found three main potential benefits in using smart phones for mobile news video creation and delivery in uplink direction. First, a smart phone is an easy to use, small and lightweight tool for news video capture. Second, it enables the fast and immediate publishing of news videos due to the possibility of delivering videos instantly from the spot of the event. Third, since everyone carries along a smart phone nowadays at all times, capturing a video of a news event is enabled at all times.

The potential benefits pose requirements related to the video capture, editing and uplink delivery in mobile context. The most important requirements directly related to the benefits are the reliability and speed of the uplink delivery of the news videos as well as the "ease-of-use" or usability of the smart phone and the mobile applications used. Further issue affecting the adoption is the satisfaction of the users with the news video quality.

In the following sub-chapters we first present the results from the point of view of the different phases, that is, video capture, video editing and video delivery in uplink direction. We then discuss the findings on the participants' perceptions on the quality of the captured and delivered video clips.

4.1 Video capturing

We found three groups of development needs and requirements for the action of capturing news videos. These issues are related to the need for fast capture, priorities of the phone functionalities and to the form factor of the device.

Starting the capturing of "passing moments" instantly when needed is important in video recording of news events. To enable this, the participants of the field studies wished for a shortcut to start the video recording directly for example with a push-and-shoot solution. If this is not possible, the interface could for example offer shortcuts for changing mode of capture instead of longer menus, using a menu structure ordered by urgency of the function, or by clearly visible icons for the mode on the screen. On touch screen devices, such as N97 and N900, the placement of clear, easily interpretable icons indicating the current mode as well as changing between photo and video modes by touching the mode icon would offer a solution for changing between basic modes of capture. Interface and interaction design should support the fast starting of recording and changing of the capture mode.

In the first field studies (1, 3, 4) with N82, the participants expressed their frustration with the incoming phone calls interrupting the video capture causing recording to stop. The same happened when using the video editor, causing current editing to be lost. The priority for the phone calls was preset as a top priority over any other phone functionality and the user was not able to control it. Therefore, whenever participants remembered, they turned the mobile phone to offline mode not only when capturing video, but also in the phase of editing. Preset priorities of functionalities should be carefully considered and avoided, if possible, since they can be catastrophic from user's point of view when the prioritized functionality interrupts the ongoing important action and task, such as video recording or editing.

From the point of view of the form factor of mobile phones, a fully, flexibly moving display, like in Nokia N93 model, was wished for. This type of design would support better the awkward working positions, like when the device needs to be raised above the heads of a crowd to record and the user is not able to see from the normal fixed display what is being recorded. In addition, the form of the device, partly due to its small size and light weight, was experienced as unstable and not easy to get a good and natural grip of when used for multimedia capture. Participants proposed to include a stabilizer for minimizing the unwanted effects to the quality of the captured multimedia. In addition, they wished for more ergonomic form factor for multimedia capturing. Therefore, the physical design of the devices should support the special needs of multimedia capture and technological solutions should be used to counteract the negative side-effects of the

otherwise positive attributes of the smart phones, such as the small size, whenever possible.

In addition, participants wished for a possibility to control the point of focus. None of the smart phone models used by the participants of the studies enabled to control the focus on a point or target selected by the user. This was expressed to constrict the shooting of videos, affecting the technical quality of the videos due to possible out of focus effect as well as limiting expression, and thereby affecting the contentual quality of the videos. Otherwise participants expressed to be satisfied with the simplicity of the video capture and found this as one of the key strengths of the smart phones in video capture.

4.2 Video editing

Findings on video editing and development are related to editing functionalities, the effects of small screen size, interaction when editing and the limited battery life-time.

The minimum requirement expressed by participants for the functionalities of a mobile video editor used with a mobile phone is to be able to 1) cut the video from beginning and end and 2) add the title of the video in the beginning of the clip and credits to the end such as the name of the creator and company. For a more ambitious journalist and photographer the third basic requirement mentioned was to be able merge two or more video clips together, which is available in the video editors of N82 and N97 models.

Enhanced functionalities were requested for a professional user who needed to edit his or her material before delivering the material. Especially photographers (visual journalists) explained that when they work as professionals, it is important for them to cut and edit the multimedia material themselves and not to deliver raw material to be edited by someone else. Due to this, many participants wished for a mobile version of a desktop video editor, such as Final Cut, but for a lighter version. Functionalities requested by participants included for example fading of audio tracks, separating audio and video streams, adding still photos in between video clips, cutting and editing multiple audio and video streams and so forth.

Contradictory to the expressed need for a full-blown video editor were the limitations experienced by participants with the screen size when editing videos (cases 1, 2, 3 and 4). Participants expressed that the screen size of N82 (2.4 inch) used in the field studies 1, 3 and 4 was inconveniently small for working comfortably with the editor and viewing the video clips. Participants suggested for example usage of external physical displays, either wireless or wired, foldable electronic paper based displays, and projecting displays “in the air” for the editing and viewing.

In addition to the effect of the limited screen size, editing video clips was affected by the limitations of the phone keyboard. Extending the phone keyboard with a BT (Bluetooth) QWERTY keyboard (Nokia SU-8W) editing was found easier and more accurate (case 4). In addition, participants suggested that editing on a touch screen phone could be easier. In the future, combining the previously envisioned projection of display “in the air” with new ways of manipulating and interacting with the displayed objects would offer a solution for the user preferred lightweight, small, single device solution for multimedia editing.

Participants also stated that the battery life-time was insufficient especially when editing videos, emptying it in field conditions too quickly. In practice this called for carrying a charger and finding a place to do the charging. The processor intensive tasks like video capture, video editing, multi-tasking, using GPS and always on wireless Internet connection are examples of the challenges for finding intelligent solutions for optimizing power consumption and new solutions for producing power.

4.3 Video delivery

In our case studies we found the uplink delivery of news videos over cellular or wireless networks to be the bottleneck for the feasibility of using mobile phones for news video capture and delivery. Users experienced the problems of uplink delivery as either lengthening of the delivery time, up to an unacceptable level or in worst case as interrupted upload or inability to deliver to uplink. This can be caused for example 1) the limited capacity of cellular and wireless broadband networks due to for example crowdedness, 2) cellular network coverage with higher data rates, such as HSUPA or EGPRS, or wireless broadband networks not being available in the spot of the news event like in rural areas, 3) the realistic throughput of delivering material to uplink from mobile phones and mobile applications being lower than the data rate available in used network at the time of uplink delivery, 4) the priority of phone calls over data traffic, limiting the available capacity for data delivery and 5) the mobility of the user while video is being delivered in uplink direction, for example due to being in a moving car.

The delivery of news videos over cellular and wireless networks is a major challenge to be solved, especially when the quality of the captured videos is continuously increasing. In addition, in our studies, the participants stated that they prefer to capture multimedia with maximum possible quality available. We exemplify the potential problems caused in uplink video delivery with an example of a video clip captured with phone model N82. A one minute video clip, which is a realistic length for a news video, is about 20 MB when captured with the best “TV” quality (VGA, 30 fps, MP4). At the time of our studies with N82 (cases 1, 3, 4) between February 2008 and May 2009, EGPRS was the fastest available data rate in cellular network provided by the used operators, having a maximum data rate of 177,6 kbps in optimal case in uplink direction, also supported by the used phone model. A one minute video of this quality takes about 20 minutes to upload over EGPRS in optimal case, but in real-life the throughput is lower. Depending on the implementation of software and hardware architecture, the limitations of the mobile device and the mobile application or service may cause the data transmission rate to drop to even 10^{th} of the possible maximum. In comparison, when a wireless broadband network (Wi-Fi) would be used, and if a realistic throughput of about 6 Mbps could be reached with the mobile system, upload would take about a half a minute.

Crowdedness of cellular networks is especially high when there is a big and important news event with other professionals and/or audience present like in the city centers at rush hours, press conferences and so forth. The publishing of news, including news videos, is typically time critical, and the material from the spot of the news event needs to be delivered instantly and reliably to be published. In the interviews with professionals we heard examples from real situations, where the journalist or photographer had tried to send the video material several times within 2-3 hours with no success and finally had to give up. The workarounds described were, that if the journalist is close to the editorial, she returns to deliver the material or alternatively, if possible, moves further

away from the crowded area trying to find a place for enabling the upload wirelessly.

Furthermore, the delays and problems in submission may prevent the usage of the system for further simultaneous work tasks, such as multimedia capture or writing a new story with a mobile application. Supporting simultaneous multi-tasking and parallel uplink delivery with other functionalities and application usage is therefore essential in work related use. Furthermore, the hardware and software architecture and implementation of the mobile device itself as well as the delivery application needs to be optimized to aim for maximum achievable throughput.

4.4 Satisfaction with the quality of the captured and published video

In the interviews participants were asked about their satisfaction of the technical quality of their captured and/or wirelessly delivered and published videos. This sub-chapter reports results related to the quality of the videos.

When smart phones equipped with a 5 megapixel sensor, Carl Zeiss optics, and capturing video at VGA quality at 30 fps were used for video capture, the participants described the technical quality of the captured and published videos "surprisingly" or "sufficiently" good and adequate especially for web publishing. The participants acknowledged that the quality of the optics, especially lenses, affects the technical quality of the captured multimedia. However, they commented that it is understandable that smart phones cannot currently offer the same quality as professional level cameras due to for example size and price constraints. Due to this, especially photographers and visual journalists commented that whenever possible, devices producing "professional" quality should be used instead of smart phones.

One of the most noticeable quality problems was related to the lip sync. With the videos captured with phone model N82 (cases 1, 3 and 4), lip sync was visibly out of sync. Participants expressed this to be annoying, lowering the quality of the videos considerably and not meeting their criteria for a material to be published. Problem was most noticeable in videos with interviews of "talking heads". In earlier studies, lip sync, or audio-video synchronization, has been found to be one of the important issues affecting the quality perceptions on consumed videos, indicating that special attention needs to be paid to this issue in system and application development.

One of the most often mentioned wish by participants of the studies was optical zoom. Participants did not want the quality of the captured video get worse when zooming digitally as they wish to record as good quality as possible. Due to this, when shooting a close-up of a person or interviewing "a talking head" the user needs to put the device very close to the interviewee. Also when a person was interviewed in close range in dim lighting conditions (case 3), the red point caused by the recording light was visible in the captured video clip - typically on top of the interviewee's mouth. Fixes for removing this problem can be found in the Internet, that is, for removing the recording light physically. Therefore, the possibility to zoom without affecting the captured quality as well as enabling the user to control manually many of the capture related features, such as disabling the recording light – if not regulated by the law - is of importance.

Lighting was one of the most frequently mentioned characteristic of the physical environment affecting the quality of the videos. Especially bright (case 1) or dim (case 3) lighting conditions were mentioned to lower the quality of the captured videos. In addition, videos captured in dim lighting were experienced as grainy. However, they exceeded the expectations of the participants and were found to be of sufficient quality for fast news situations. The ability to manually set shutter speed and f-stop is maybe the most fundamental need for a photographer or multimedia journalist and needs to be paid attention to in the future.

Another characteristic of the physical environment, which affected the satisfaction of captured news videos, was the audio scenery (cases 1-5) in combination with the internal microphone of the used smart phones. Internal microphone easily picked up background noise, such as from passing traffic. The interviewee's voice was also very silent unless the microphone was close to them. To enhance the quality of the captured audio, participants wished for a possibility to use an external microphone for audio recording. In addition, participants wished for a possibility to monitor the audio while recording video to ensure the quality. In combination these two requirements either call for two physical plugs, or use of wireless technologies for either or both cases.

The delivery of video clips wirelessly caused also some problems in the quality of the published videos. Occasionally frames were missing from the published material or only part of the video clip was received. In our studies these problems seem to be related especially to the available data rate of cellular network in heavy loading situations, but may also be caused in combination with the implementation of the delivery application and throughput of the mobile device. Based on our studies, we cannot make definite conclusions on what exactly caused the quality problems.

5. DISCUSSION AND FUTURE WORK

This work focused on understanding development needs when smart phones with multimedia functionalities are used for professional news video capture, editing and uplink delivery in mobile context. Based on five user studies implications for the design and development of mobile phones and editing application are presented. In addition, practical solutions and development needs are described for coping with the situations when cellular and wireless broadband networks provide low data rate.

For the design and development of mobile phones, following implications were found specifically related to mobile news videos:

1. Push-and-shoot or other shortcut solutions to enable immediate starting of video capture.
2. Contextualized priority of phone functionalities, so that important action and tasks, such as recording or editing of videos are not cut-off without user's possibility to control.
3. Enabling simultaneous multi-tasking, so that for example uplink delivery of news content does not prevent other tasks and using other phone functionalities, applications or services.
4. Extending the limits of the small screen size with external, projector based, or mixed reality displays when working with the captured material, such as when editing.
5. Enabling alternative ways of interaction beyond the phone keyboard especially for video editing. For example, touch screen, external physical keyboards, bodily interfaces, or manipulation of virtual objects for mixed reality displays.
6. Supporting with the design and form of the device the specific needs of multimedia capture, such as a flexibly moving

display, the placement of the recording button and the firm and stable grip when holding the device while recording.

7. Enhancing the quality of the recorded audio by enabling the usage of external microphone and simultaneous monitoring of the quality of the recorded audio.
8. Enhancing the technical quality of the captured videos and enabling more freedom in expression (contentual quality) by providing optical zoom, enabling focusing on selected target and offering control over shutter speed and exposure time. In addition, sufficient frame rate and the quality of the lenses should be as high as possible.
9. Offering for editing a mobile video editor with functionalities similar to desktop editor, such as separating audio and video tracks, cutting, editing and merging several video and audio tracks, fading audio track and adding still photos to the video.
10. Optimizing the power consumption or finding other solutions to extend the battery life-time.

In addition, one of the greatest bottlenecks for uplink delivery of news videos are in hectic news situations the crowded cellular networks, unavailability of open wireless broadband connection, fast mobility of the user while delivering to uplink, or in rural areas for example lower bit rate connections, such as GPRS. In addition, the throughput of the mobile system itself needs to be maximized. The following solutions could support the needs of fast video delivery:

11. Lowering the quality of the video to be delivered based on the available bit rate or purpose of using the video. This could happen either automatically or by user's decision. Update of delivery with better video quality could be offered when the available bit rate is higher.
12. Creating intelligent solutions for network selection and utilizing the free capacity of the closed wireless broadband networks.

Presented results are in accordance with well-known limitations of the mobile devices as described for example by Zhang et al. [11]. Results confirm and extend previous results in mobile journalism related studies presented in [2], [5] and [6] on limitations of screen size and keyboard, satisfaction with the quality of videos, desire for more control over adjustments while capturing multimedia, as well as limitations of battery life-time and delivery. In addition, this work presents potential future needs and requirements when designing and developing mobile phones and applications for mobile video production. Results can be applied not only when designing for professional news video production with smart phones, but also partly apply in other fields of mobile work and more generally in consumer contexts in case of mobile video capture, editing and delivery.

Several lines of future work can be proposed based on the findings. First, studies on supporting the work in mobile context with new display solutions, for example projector based or mixed reality displays, could be done. Extending the studies on displays with interaction techniques, including virtual manipulation of the multimedia material and application in case of mixed reality displays would offer new alternatives for envisioning the future of mobile field work. These studies should also include the aspects of social acceptability both by the users, as well as externals.

Second, studies on acceptability, feasibility and satisfaction when lowering the captured video quality for mobile uplink delivery based on available data rate could include perspectives of the producer of the material in mobile context, the consumer of the news on various end devices and the viewpoint of media houses or news agencies Finding the acceptable levels for technical quality for example based on the urgency of reporting the news could be identified based on the studies. Third, further studies on identifying needs for supporting personalized work flows in mobile video capture, editing and delivery would provide basis for further application and service development.

6. ACKNOWLEDGMENTS

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Paper 6

Väätäjä, H. 2012. Mobile work efficiency: Balancing between benefits, costs and sacrifices. *International Journal of Mobile Human Computer Interaction (IJMHCI)*, *4*(2). pp. 67-87.

Paper 7

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Briefing News Reporting with Mobile Assignments – Perceptions, Needs and Challenges

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ABSTRACT
Mobile handheld devices are an increasing part of everyday fieldwork of news professionals. Mobile assignments delivered to mobile journalists' smartphones are one potential future development step. We present findings on using mobile assignments from two exploratory user studies in which smartphones were used as news reporting tools. Mobile assignments were perceived as handy for fast reporting situations and simple stories but challenging in case of more complex tasks. Structured information content of assignments, process phase based information and supporting situation and activity awareness would support the work of both editorial staff and mobile journalists. The locationing of reporters for sending location-based assignments was found acceptable for coordinating the work although some privacy concerns were expressed. The findings provide new information on using mobile assignments in work where carrying out tasks involves creativity and the tasks may be complex, not strictly limited or they may not have clear completion criteria.

Author Keywords
News; journalist; smartphone; mobile; assignment; task; work; location; professional; crowdsourcing; privacy.

ACM Classification Keywords
H5.3. Computer-supported cooperative work.

General Terms
Design; Experimentation; Human Factors.

INTRODUCTION
Mobile devices and services are increasingly being adopted for keeping track of the mobile work force, coordinating work, enabling group cooperation and awareness, distributing tasks to workers and following up on the accomplished work in various fields of work [2,3, 24,22,23]. Mobile assignments, that is, tasks sent to mobile, handheld devices such as smartphones and tablets, are being taken into use in organizational settings such as home care, maintenance, and emergency response.

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Due to economic pressure news industry is facing changes in how news are made. For example, the editorial staff numbers are reported to have fallen since 2007 by 27% in British news media industry [4], with an increase in subcontracting, freelancing and reader participation. Mobile and location-based assignments therefore seem one attractive alternative for coordinating news reporting work. Not only reporters employed in news organizations but also freelancers and reader reporters could be reached for carrying out tasks. As a new story to cover comes up, the closest available reporter could undertake the assignment. However, little is known about how mobile assignments fit to a professional mobile journalists' work, which can be characterized as creative, relying on professional's skill and autonomy and being a collective effort [6]. Furthermore, in news journalism the tasks to be carried out may not be strictly limited, or the completion criteria may not be clear at the time of creating the assignment. This is the case, for example, when reporting breaking news like catastrophes.

Mobile assignments change the current work practices, introducing challenges and needs related to the content of mobile assignments, news production processes and for mobile technology and services to be utilized. Professional reporters' own insight and experience as well as negotiation with the newsroom are traditionally important aspects of news making. Mobile assignments therefore not only change the current work processes, but also potentially change the roles and responsibilities of reporters and the editorial team in the newsroom as well as their workflows.

This paper explores reporters' perceptions and needs as well as emerging challenges on information content and assignment related processes when using mobile assignments for briefing news assignments to professionals. Furthermore, we address a possible future scenario on utilizing reporters' location information in organizing news reporting work. We present here the findings on mobile and location-based assignments from two field studies in which smartphones were used for making news. Reported two field studies are from a set of ten case studies related to professional news making with smartphones [29].

The paper is structured as follows. We first present the background of the study with a discussion on how mobile systems and assignments may change the current news making practices followed by a review of related work. Then the two user studies are introduced with findings on

using mobile assignments and locationing in news reporting. We conclude with a discussion of the findings and the potential effect of the mobile information and communication technology (ICT) on work practices as well as proposals for future work.

BACKGROUND

The goal of our work was to support the development of a mobile service for mobile content co-creation and mobile work with a specific focus of our studies being in the context of news journalism. The first mobile service prototype was originally developed in 2007 at Nokia Research Center in close collaboration with journalists at Reuters for creating and delivering news stories.

During our first user studies in 2008 [12,27,29,30,31], newspapers were increasingly receiving user-generated content based on readers' own initiative. However, no mobile service clients existed for systematic requests for readers' content by a mobile phone, such as for example Tackable[1] today. In addition, indications from news organizations suggested that mobile assignments could be useful for professionals and freelancers. These needs motivated the development of an online and mobile production solution with an online assignment desk (dashboard) resembling the solution provided by kapost[2] and the Assignment Desk[3] plugin for WordPress. To support the mobile news content creation, mobile service client prototypes were developed which aimed to fit both crowdsourced news content creation and professional use. Mobile assignments and the usage of location information are currently implemented to a generic solution for mobile work processes for fieldworkers[4].

From traditional practice to mobile reporting

Traditional newsroom assignments are generally agreed at news conferences. The editorial angle, the duration or length of the story and its position in the running order or prominence in the paper is agreed by the editor. A resource is committed to cover the story in line with its scale and importance. In the case of a print story this may require a reporter and a photographer. A video or a mobile journalist working for a local paper will be expected to record audio and video. If the mobile journalist uses a mobile handset to record audio and video, it is likely they will also be expected to shoot still images and provide a copy in the field. Consequently, the assignment brief from the editorial team must be specific about what media is required.

A mobile journalist working with the small keyboard built into a smartphone will not easily or quickly be able to type a 400-word story. The story may be better compiled by a production journalist in the newsroom with access to a full size keyboard. However, she/he will require factual details and might prefer written quotes from interviewees along with captions that are spelled correctly in text form. This approach to the editorial workflow changes the nature of the assignment briefing breaking an assignment down into component parts. In addition, this workflow enables the newsroom to reflect the emerging story by quickly adding rich media (audio, video) elements as the story develops.

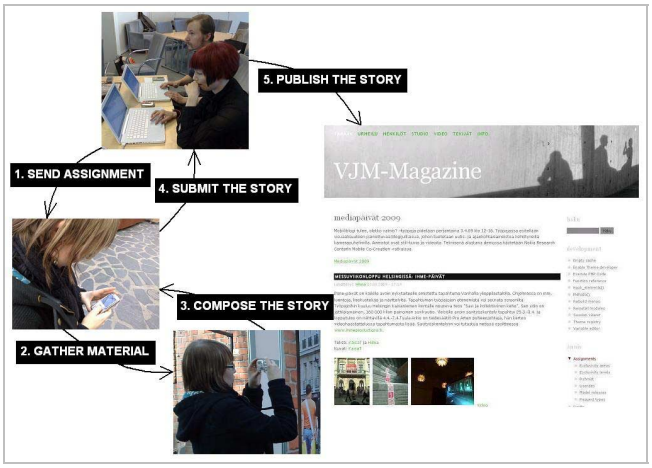

Figure 1. Simplified work process phases with mobile assignments from Study 1 [19].

Reporters using traditional methods for reporting stories do not generally 'drip feed' information to the newsroom in the manner that mobile journalism enables them to. The new process also opens the possibility for dialogue with the editorial team in the newsroom, who can respond to the information as it comes in and further refine the assignment brief by offering specific instructions to reporters. For example, after bringing together elements of a story in the newsroom, possibly from a number of reporters as well as readers, the team might assign a mobile journalist to shoot three 'vox pop' interviews as a reaction to an event. The editor could even go as far as sending the question to be asked of the interviewees to the reporter as part of the brief, knowing exactly where the video content will fit within the story once the reporter sends it back.

From within the editorial platform, the editorial team can evaluate the quality of the material sent by the reporter from the handset whilst they are in the field. The reporters can respond to requests from the newsroom and/or reshoot material or gather further information from contributors without leaving the scene. Consequently, the mobile assignment briefing of reporters differs fundamentally from the traditional practice partly because the mobile device and the reporter using it provide the editorial team with an open channel to direct the acquisition of content and to receive it from the field in a more interactive manner. This changes the role of the editorial team in the newsroom who can now be more directive if they so choose. It changes the role of the reporter, who may sometimes be responding to specific requests for particular media or interviews with contributors, and who may sometimes work proactively by

[1] http://www.tackable.com
[2] http://kapost.com
[3] http://openassignment.org
[4] http://www.newelo.com

feeding material to the newsroom more regularly. And with the evolution of these roles comes a change in the relationship between the reporter and the newsroom staff commissioning stories.

In this paper we focus primarily on the front-end of the mobile news reporting process (see Figure 1), concentrating on the issues related to mobile assignments. Our research covers the phases when creating and sending mobile assignments as well as when receiving and acting on a received assignment. In addition, we touch upon the needs when reporters have covered and submitted the story or material for the assignment.

RELATED WORK

Much of the HCI and CSCW research in the context of news reporting has concentrated on the work practices and organizing the editorial work, e.g., [10,13,11]. Mobile pocket-sized devices, like PDAs (personal digital assistants) or mobile phones, have in recent years received increasing attention [8,9,12,16,27,28,29,30,31].

Fagrell et al. [8] and Forsberg [9] studied PDAs with service prototypes for knowledge management in the first phases of reporting when transforming events into newsworthy stories. The aim is to provide mobile users with timely, contextual information related to the story they are covering. The provided information is related to the background information, such as previous reports on the topic, available expertise of others, and coordinating reporting with other reporters. In their solution, the worker creates him/herself a To Do item on the application, based on, for example, a phone call they receive, or after an editorial meeting. In our work the assignments are created by editors, producers or others responsible for coordinating the news production. Mobile assignments are then delivered to the mobile journalists' mobile devices, such as smartphones or tablets, via a mobile service. Our work, therefore, complements the work of Fagrell et al. and Forsberg by concentrating on the needs and challenges that arise especially for information delivered in the assignments and the related process when using mobile assignments for briefing news reporting.

Verburg et al. [26] studied the mobile virtual work of mobile customs employees, elevator service engineers, facility management and home care. They report the benefits of mobile virtual work to be, for example, increased efficiency experienced by employees and for organizations the possibility to track employees on the move and allocate unscheduled work better. Furthermore, Koponen et al. [16] report that the motivation to use mobile phones for writing text for news was the more efficient use of time and independence of time and place; "whenever inspiration hits".

A number of studies have been conducted on developing and evaluating context-aware and/or location-based services [8,24,22] for mobile field work. Our interest lies in reporters' perceptions on locationing, for example, when sending location-based assignments to the reporter closest to the scene of a newsworthy event. Previous studies on sharing location information show contradictory results on users' perceptions and concerns. For example, Consolvo et al. [5] report as the most important factors affecting willingness to disclose location information to be the identity of the requester, the reason for requesting and the precision of the request. In the study by Raento et al. [18] with two groups of office workers, users had no expressed concerns for automatic location disclosure when the revealed location was approximate on the level of the district and city. However, the organizational culture at the work place, trust and authority issues, as well as perceived benefits may influence results significantly in practice.

METHODOLOGY

We used a case study approach [32] to conduct two field studies where briefing news with mobile assignments and locationing were included as research themes. In both studies (Table 1), smartphones were used for delivering news briefings through mobile assignments, as well as for capturing, editing and delivering news content.

Setting. The field studies were conducted with postgraduate students of journalism and visual journalism within university course curricula. We used students as our sample because the system prototypes could not be integrated to the editorial systems with reasonable time and effort. Within their studies, students carry out practical news reporting tasks and publish real news stories with an editorial team and mobile reporters. Using the system in realistic, collaborative news reporting situations brings out usability issues, perceptions, and needs that usability tests in a laboratory [17] or heuristic evaluations [15] may not reveal.

The students' goal was to create, edit and deliver news content from the location of the news event with smartphones and an application dedicated for mobile news assignments and news content delivery. The researchers did not assign tasks to the participants. Instead, the reporting tasks were assigned within the course setting. The created news material was published in course-related online publications (Studies 1 and 2) and in a printed course-related newspaper (Study 2).

Participants. Most participants had extensive part and/or full-time work experience in the field of journalism (see Table 1). Work experience had been gained as freelancer work before or during the studies, working as a part-time or full-time, as internships and as summer traineeships.

Mobile devices and applications. The smartphones used in the field studies (see Table 1) were Nokia models N82 and N900 with multimedia capabilities. The iteratively developed mobile client application prototype versions used in the studies for mobile assignments and content delivery were fully functional prototypes developed at Nokia Research Center for Study 1 and at Newelo for Study 2.

Study	Nr of part.	Mobile Phone	Mobile client	Collected data (as hours or number of participants)	Research themes on mobile assignments	Participants (based on number of questionnaire respondents)	Other information
1 (Case 4, spring 2009)	8	Nokia N82 (Symbian): 2.4 inch display, numeric keypad, BT keyboard	MCC pre1	o (36 h), fc (8), q (8)	Information needs, locationing	Gender: female (7), male (1) Age: min-max=24-46 yrs, mean=30.4 yrs Work exp.: (part and full time).: min-max=1-25 yrs, mean=6.6 yrs	Students of visual journalism (photographers) used the mobile system on two pre-trial days and during one day in a media conference workshop demonstrating mobile journalism
2 (Case 10, fall 2010)	11	Nokia N900 (Maemo): 3.5 inch touch-screen display, full keyboard	N4F pre1	o (32 h), i (4), q (11)	Perceptions, needs, challenges and feasibility of assignments, locationing	Gender: female (6), male (5) Age: min-max=21-30 yrs, mean=25.0 yrs. Work exp. (part and full time).: min-max=1-27 months, mean=12.7 months	4 participants in Finland (students of visual journalism) used the mobile system over a period of one month; 7 participants in Great Britain for 5 days (6 print journalism students, 1 broadcast).
o = observation, i = interview, q = questionnaire, fc = focus group MCC pre1= MCC prerelease version 1, N4F pre1=Need4Feed client prerelease1							

Table 1. The conducted user studies addressing the usage of mobile assignments and locationing.

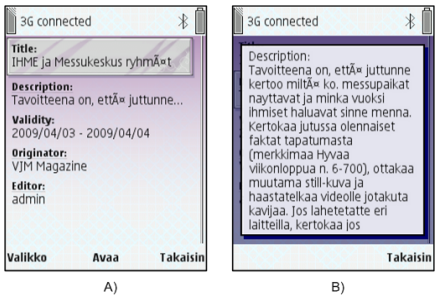

Figure 2. Study 1: A) The main UI of the MCC mobile client and B) The task description field.

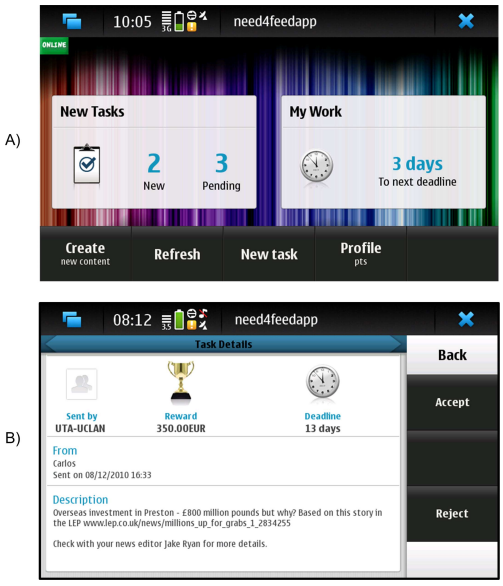

Figure 3. Study 2: A) Opening UI of the Need4Feed mobile client and B) an opened assignment with details.

Both prototypes enabled the receiving of mobile assignments, accepting and rejecting them as well as replying to the assignment with news content (complete stories, photos, videos). The MCC prototype (Figure 2, Study 1) includes as assignment information fields "Title", "Description" of the assignment as a free text field, time for the "Validity" of the assignment, "Originator" for the publication and "Editor". The N4F prototype (Figure 3, Study 2) has as an opening interface an overview of the task situation. Main differences on information of the assignment compared to MCC prototype are "Reward" aimed for freelancers and crowdsourcing and "Deadline" indicating the time left to deadline. A major functional difference between versions is in the UI which is intended for touch screens in Study 2. In both studies, smartphones were used for the capturing and creating of news content (text, photos, video clips) either as the only devices used, or as one system among the others. Participants were free to use any other feature or functionality of the devices as well.

Data collection. The data collection methods varied depending on the study (see Table 1). In the first study, four researchers observed the participants on three days, whereas in the second study, one researcher observed selected participants on six days, during one day in Finland and five in Great Britain. The observations covered mobile system usage in field conditions as well as editorial work. At the end of Study 1, a focus group was held and a printed questionnaire was used to collect background information. In Study 2, four interviews were conducted in Finland and an online questionnaire was conducted with both Finnish and British students covering a wider range of themes related to perceptions on using mobile phones and services in news reporting. Privacy issues were not addressed directly by the researchers in the interviews and focus

group, but they arose spontaneously in the participants' comments on locationing related themes.

Analysis. The hand-written field observation notes as well as audio recordings of the interviews and the focus group were transcribed. This data as well as data from the open-ended questions in the questionnaire were analysed by data-driven content analysis using open coding for emerging themes and grouping these under higher level categories. Closed ended questions from the questionnaire were analyzed by descriptive statistics.

RESULTS FROM STUDY 1

In the first study, two participants acted as editors of a mobile newsroom for an online publication, editing and publishing the material, and a producer (course leader) sent the mobile assignments to the reporters. The rest (six) were mobile reporters, who carried out the assignments in a mobile context. We present the findings on the editors' and reporters' needs in the mobile assignment process, as well as on locationing.

Needs in a mobile assignment process

Coordinating news reporting

Table 2 presents the information needs of the editorial staff and the willingness of the reporters towards sharing this information when sending mobile assignments to reporters. The reporters were willing to disclose information that could be used for profiling, but wanted to remain in control of their availability as well as of the locationing.

Editors' information needs	Reporter's willingness to share
Availability for carrying out assignments	Conditional: When on duty; As a freelancer when ready to undertake a job
Reporters' equipment	OK
Reporters' skills, special expertise or interests	OK
Location of reporter(s)	Conditional: Not all the time; In urgent reporting needs; When on duty and/or chooses to enable locationing; As a freelancer when ready to undertake a job; If the precision of the locationing can be approximate; In dangerous areas with safety risks.

Table 2. Information needs when assigning news reporting tasks.

The locationing of reporters raised primarily strong negative first reactions in the focus group participants, such as "*annoying*", or an expression of disgust, covering issues like "*feeling of being monitored*" or "*tracked*". As the participants continued the discussion, they mentioned specific cases or conditions in which they would allow the locationing, as exemplified in Table 2. The participants wanted to remain in control of the locationing and its precision, but some also mentioned that during working hours, the locationing of reporters would be acceptable, and sometimes even desirable for increasing the feeling of safety in dangerous areas. In addition, the participants expressed concerns indirectly, for example, related to losing freedom of how they spend their time.

Making sure that news material will be delivered

Traditionally, news reporting involves a high degree of planning, at the same time being prepared for rapid and unexpected changes to the plans. The participants emphasized that it is essential that the newsroom staff is aware of the current situation with the mobile assignments. The editors expressed that they felt unsure and nervous whether the reporters were going to carry out the assignments. In the study we found that the reporters read the assignment, but even though accepting and rejecting was enabled in the application, the reporters did not always remember to do it. The editors felt an urge to call or send a text message to make sure that the assignments were received and understood. Support was therefore needed for knowing whether the respondent(s) 1) has read the assignment, 2) has understood the assignment or needs clarification and 3) is going to carry out the assignment, especially if it is sent only to one or a few reporters.

In addition, the editors wished for information on 1) when to expect the story or the material, 2) whether there were significant problems in carrying out the assignment to negotiate the issues and 3) whether the story or material will be on time or delayed. This enables the editors to foresee changes in the publishing schedules, or a need for replacing the planned story with a new topic if needed, using photos from a photo agency or their own archives, for example, instead of the content that was planned.

Is someone else already covering the story?

One possible scenario is that the assignment could be delivered to a number of reporters, such as freelancers, to increase the possibility of someone undertaking the assignment, for example, in fast reporting situations. First, we found that the reporter would need to know whether he/she was the only one getting the assignment or whether it was sent to a number of reporters. The participants mentioned that their attitude towards the assignment is completely different if they know that they are the only receiver or if it is sent to a larger group for one to undertake. Second, if the assignment is sent to a number of reporters but intended for only one or a few to carry out the reporters need to get information if the assignment has been undertaken. Therefore, the mobile service should support delivering this information to others, as implemented in the study by Alt et al. [1], for example, in the case of mobile crowdsourcing.

Is further action by the reporter needed after submission?

The feedback provided by the MCC prototype when submitting news stories and media was found insufficient. The reporters wished for an automatic confirmation that the material was received by the editorial system. After the news story or material has been delivered by reporters, the editors may need to check some facts or details related to the stories from the reporters or ask for updates, or for more material. The reporters mentioned that they would need to know whether the assignment was completed as is or whether further action or information is needed. In most

cases, the participants mentioned phone calls as the natural solution for this communication, but also chat, text messages (SMS) and email were mentioned which are already offered on most smartphones.

The newsroom needs to stay in control of news reporting

The MCC prototype enabled the creation of assignments from the mobile journalism client. The participants found creating news assignments with a mobile client as a possible scenario in the case of an urgent, newsworthy event. However, they seemed strict in their opinion that this is used to notify the editorial staff in the newsroom, which should remain in control of organizing news reporting and the delivering of assignments. For example, a reporter working in the field should not create a new assignment or delegate a reporting assignment he/she had received to a colleague. This was justified by the fact that the editorial team is responsible for coordinating the production. If assignments would be delegated between reporters, the newsroom could not stay up to date on the current situation, who is covering an assignment or a news topic, and take action if needed.

Reporters' needs for information in mobile assignments

The participants found the free text field of the prototype for assignment description to increase the possibility that important information is missing from the sent assignment. Similarly, structured information was mentioned to help reporters in using the assignment as a checklist in a mobile context. Identified needs for the information content are:

- The topic to be covered with (1) Basic information on the location (address), event/interviewee, (2) Background information such as links to information, old articles, etc;
- What kind of content is asked for (text, photos, video, audio), e.g. the (1) Length of text (e.g. nr of characters), (2) Number of photos and video clips, (3) Length of audio and video, and (4) desired quality or special requests for the media content;
- The reporting schedule and deadline(s), including information such as whether a fast report with certain material is wanted first and more material or updates later.

This information is similar to the information that reporters and freelancers in the current work process get and take along as notes when they leave to cover a story. However, when designing for a mobile phone's relatively small screen and for mobile usage situations, the design needs to have a clear and simple structure and provide the most important information preferably with one glance.

Reporter as an orchestrated "puppet"

Focus group discussion on mobile assignments and mobile reporting raised also a spontaneous and lively discussion on future work practices and the role of the professional reporter in case when news briefing would be mediated for example by phone or video calls and live streamed videos. Participants envisioned reporting scenarios ironically where the reporter would not use their own professional judgment and instinct in reporting. Instead, the reporter would ask the editorial staff should they take live video footage of the situation, what angles to capture and so forth. Participants spontaneously ideated a reporting situation on an accident scene, where people would be screaming in pain and the reporter would continuously ask for directions from the newsroom what to report and how. It appears that in this exaggerated future vision participants expressed their fears related to the effect of new technological solutions on their work. Technology would enable the newsroom to orchestrate the reporting more than reporters wished for and change the work practices and role of reporters fundamentally from a creative, skilled and relatively autonomous professional to a puppet that could in practice be anyone present at the scene of the happening.

RESULTS FROM STUDY 2

The second field study presented here was conducted in Finland and Great Britain (see Table 1). This study was used to complement and extend the previous findings with a new prototype version and to identify possible changes in the perceptions to support further development, with locationing as a special focus of the study. The Finnish participants (4) relied solely on mobile phones for the entire news reporting process. All their news reporting was based on news briefings sent as mobile assignments. The participants in Great Britain used the mobile phones as one device among their usual news reporting gear.

We first report the participants' general perceptions on mobile assignments. We continue with discussing the perceived benefits and disadvantages of mobile assignments, followed by a set of new information needs identified when using mobile news briefings. At the end of this section, we report the locationing related results.

Mobile assignments in general

The general perceptions of the respondents towards receiving mobile assignments on a mobile phone were assessed with sentence completion [21]. The respondents were asked to complete the sentence *"Receiving mobile assignments on a mobile phone is…"* with 1-3 endings. The responses (29) are presented in Table 3 and categorized into positive (11) and negative (18) perceptions. Four of the respondents completed only negative sentence completions, two only positive ones and the rest had both positive and negative sentence completions. The total number of negative perceptions is higher than of positive perceptions. Finns (4) created more positive completions than the British students (7), and considerably fewer negative completions. This may be due to the Finns relying solely on the smartphone-based solution, therefore getting more hands-on, real-life usage experiences. We discuss the results presented in Table 3 more closely in the following subsections, combined with the interview findings.

Benefits of using mobile assignments

The advantages of mobile assignments were described in the sentence completions to be related to quickness, as well as to ease-of-use and practicality (see Table 3). Some respondents (3/8) also found mobile assignments in general a good and important feature.

The interviewees mentioned as an advantage from the editors' viewpoint to be able to reach a reporter with mobile assignments instantaneously, independent of his/her whereabouts, needing no other equipment than a mobile phone. Furthermore, by being able to reach several reporters simultaneously, it is faster to find a person to undertake the assignment than by calling. Similarly to the first study, the mobile assignments were mentioned to be suitable as memory aids or notes, supporting mobile work. Compared to emails, the mobile client was also mentioned to be faster and more effective in finding assignment related information than browsing through the emails.

The interviewees perceived the usage of mobile assignments is especially suitable for catastrophe and accident journalism or similar fast news reporting situations. In addition, one of the interviewees described how mobile assignments remove the need to go the newsroom for news briefings:

"It is surely useful, at least in very fast news reporting work. And with small stories it is surely cost-effective that one can do the whole job, that one does not need to go back to the newsroom and the computer there, but you can do it all in a café and then go to the next news reporting gig. And you do not need to go and listen to the briefing at a certain location, and all this, at least for a fast pace it fits well." P-123

Drawbacks of using mobile assignments

The most commonly mentioned disadvantages in using mobile assignments based on the questionnaire answers were: 1) disturbing the process, 2) usage inefficient compared to a phone call which is traditionally used, 3) disrupting communication, and 4) seeing no clear benefit in using mobile assignments. One of the responses refers to the role and skills of the reporter in the changing work practice, by mentioning that assignments constrain the reporters's own instinct.

In addition, the interview and questionnaire results on development needs reflect our findings from Study 1 on the importance of clear and sufficient instructions. Missing or unclear information leads to a need for contact and communication. In addition, some participants perceived it to be faster and easier to call a person than to fill in a form online and follow up its completion. Overall, if the goal is to limit, minimize or even remove the need for communication, for example in the case of crowdsourcing, then the information and instructions given in assignments need to be paid attention to.

The participants also found the feasibility of mobile assignments to be related to the type of stories covered. As previously mentioned, small stories and fast news reporting situations were found to be suitable cases for getting news briefings in mobile assignments. However, larger feature stories were felt to not fit as a story type into the mobile assignment delivery. One interviewee explained:

"I feel it would not fit an extensive feature story like when one gets a given assignment from somewhere, so that the certain type of ideal..., and discussion, when in some kind of meeting it is discussed what will be in the story, when it is completely left out, then it does not fit like that, it does not correspond to what my experience is, how these big stories are done. When the assignment is sent, they do not have any idea of what I intend to do when it is not limited like that. Or the other way around, I do not have a slightest idea of what is really wanted." P-123

Perceptions	Categories	Sentence completions
Positive (11): Finland (6) GB (5)	Quickness (4)	Quick, instant, time saving, fast
	Easy, Simple, Practical (4)	Easy (2), simple, practical with basic stories
	Good, important (3)	A good idea, important, excellent feature
Negative (18): Finland (4) GB (14)	Disturbs process (4)	Hassle; not ideal; impossible for unexpected topics; sometimes full of technical problems
	Inefficient (3)	A waste of time; unnecessary extra layer of bureaucracy; most effective with a phone call
	Prevents or disrupts communication (5)	Easier to speak directly to be able to clarify aspects of story; difficult if one has questions and needs to discuss the assignment; most effective with a phone call; demanding in case of needing more information; possibility for misunderstanding
	Diminishes professional skill (1)	Constraining the reporter's own instincts
	Sentiment (2)	Impersonal, annoying
	No benefit (3)	Pointless, unnecessary, not giving clear benefit

Table 3. The results of sentence completion for *"Receiving mobile assignments on a mobile phone is…".*

Reporters' needs for information in mobile assignments

As in the previous results, the participants emphasized the importance of a deadline as it gives the reporter an easy indication of *"…whether I have the possibility to undertake it"* (P-123). In addition, the participants found it useful to see the remaining time to the set deadline as provided. Further information needs found are:

- The intended usage context of the story/material, e.g. online, print, TV, radio/audio
- The type of the story– this can be described, for example, by (1) the intended department or category in the publication, or (2) using journalistic language and/or language of publications' staff, such as main/local news, column, first page, feature, short interview, premium, "grab by the sleeve" profile.
- The viewpoint or perspective to take to cover the story - for instance a lead, or whether it is up to the reporter to decide it
- What is wanted to be the object, target or angle of capturing photos or videos

Results corroborate and extend the results from the first study by showing that more contextual descriptions related to the intended usage and perspectives of reporting are needed in the assignment descriptions of professionals.

Locationing related results from the questionnaire

To study further the locationing related themes in mobile assignment processes, we included these themes both in the online questionnaire and the interviews.

Sharing location is risky, but not particularly worrying

To gain an assessment of the participants' perceptions on sharing location, we asked three questions. We followed the approach by Tsai et al. [25] for the general questions and scales. The following questions were asked:

- *How useful do you find sharing your location with others based on your mobile phone location?* (1=Not useful-7=Extremely useful) Md=2, M=1.91, SD=0.94
- *How concerned are you about sharing your location with others based on your mobile phone location?* (1=Not concerned-7=Extremely concerned) Md=5, M=4.36, SD=2.20
- *In general, what do you think about sharing your location with others based on your mobile phone location?* (1=Risk far outweighs the benefit,7=Benefit far outweighs the risk) Md=3, M=2.73, SD=1.35

In general, sharing one's location was not rated as useful, in addition to it being assessed as somewhat risky. The responses regarding concern about sharing location were more neutral, but also more dispersed. Furthermore, we asked whether the participants would want to stay in control when their mobile phone can be located in news production. Most respondents (8/11) wanted to stay in control of locationing, reflecting findings from earlier privacy studies.

Acceptability of locationing

We also asked for general perceptions on the locationing of the mobile phone with an open-ended question: *"In general, how do you feel about the locationing of your mobile phone?"* Six (6) respondents were negative towards locationing, whereas five (5) respondents were positive under specific conditions. The concerns mentioned in the responses were described as 1) Feeling uncomfortable or stressed about someone being able to know where one is, 2) Unnecessary monitoring, and 3) Invasion of privacy.

Locationing was mentioned in the answers to be acceptable for keeping track and organizing the workforce, proving the authenticity of the narrative from the scene, mapping a reporter online or on TV, or when covering something dangerous, in a life-threatening situation, when missing.

In the questionnaire, we asked with an open-ended question, *"Whom would you give a permission to locate your mobile phone?"* Five respondents mentioned *editor, producer or a* similar *senior figure*, one of these adding "*...if absolutely necessary as a freelancer*". In addition, the participants mentioned *a trusted colleague or fellow reporters* (3), *authorities* (3), *a friend* (1) and *no-one* (1).

Acceptable situations for locationing were asked with the open-ended question *"In what situations would you give permission to locate your mobile phone?"* The reasons mentioned were related to 1) foreseeable benefits in organizing work, for instance, to keep tab of the area to be covered or dividing an area between reporters, or for the reporters themselves, for instance to be directed to a story, and 2) protecting one's safety in a dangerous area. In addition, the participants mentioned acceptable situations, such as when on-call duty or when covering a story. The results are similar to the previous study, with potential tensions between privacy related issues, such as a feeling of being monitored and the possible foreseeable benefits.

Locationing reporters assessed as useful

To gain an understanding of the participants' perception of the usefulness of locationing, we asked them to rate three statements with a 7-point Likert scale (see Table 5). The first statement is from the point of view of the newsroom locationing the reporters in the field. Most respondents agreed at least to some extent with this statement. Similarly, most respondents agreed to some extent about the usefulness of locationing fellow reporters.

Statement – It would be useful…	Md	M	SD
…, if the newsroom could locate the reporters working in the field.	5	4.64	1.63
…, if the reporters could locate each other when working in the field.	5	4.55	1.51
…, if the reporters could locate their informants.	5	3.82	1.78

Table 4. Usefulness of locationing.

Locationing related results from the interviews

The benefits of locationing mentioned in the interviews were similar to the questionnaire answers and the results of Study 1. Location-based assignments were described as useful and handy to find the reporter closest to the scene of an event, as well as for finding out where reporters or freelancers are and using this information for coordinating news reporting. In addition, locationing was found useful in fieldwork for the locationing of a colleague working in the field to coordinate the work with them, such as meeting up when covering stories, or more generally sharing progress related information.

The interviewees seemed to consider whether locationing really is acceptable, but at the same time agreeing on possible benefits under certain conditions. One interviewee discussed how it depends on the country whether she would consider it safe and would trust to share one's location even in a professional context:

"...I do not know if it is a problem like, in conditions such as in Finland because this is a constitutional state… but since I have lived for quite a long time in Latin America, I would indeed not want that anyone could locate me since the risks there are much more substantial, or if one thinks about the political situation in [removed]. It would be really easy to locate certain reporters… it is not like your employer is… there are all these kind of hackers that can find out the information, then… it would work in Finland, but if one thinks in a bit wider context, then it is not good." P-124

The privacy related themes are otherwise similar to those found in the first study and in the questionnaire results of this study. The results therefore corroborate those findings.

DISCUSSION

In this section we discuss the themes and findings that emerged in the studies and point paths for future work.

Mobile systems and mobile assignments change work practices, including roles and responsibilities of both mobile journalists and newsroom staff. These changes on one hand provide new opportunities but on the other hand may appear as threats to the traditional role and responsibilities of the professional and his/her professional identity. These issues are not only driven by technology push, but also due to the organizational pull for enhanced performance. In our studies performance related impacts mentioned by participants were for example the diminished need to go to the newsroom for picking up assignment sheets as well as less need to participate editorial meetings. Being able to submit news content wirelessly from the field "anywhere, anytime" enables time savings for the journalist and makes news publishing faster. In addition, sharing of situational and activity related information enabled by locationing enhances not only coordination of work, but also knowledge sharing and collaboration of mobile reporters. There is a clear paradigm shift in news media industry due to changes in both consuming and producing news that drives towards new forms of production. These include outsourcing news content creation to freelancers and crowdsourcing or co-creating news with readers. ICT solutions need to support these needs (e.g. [28]).

New forms of mobile reporting are enabled by mobile technology and mobile assignments. In our studies participants compared the capabilities of the mobile systems and mobile assignments to traditional news making processes and how they fit into and can be used in these processes. The theme of "journalistic ideal" appears directly and indirectly in the perceptions of the participants. It is also related to their professional identity and role [7]. For example, in the first study participants perceived reporters passing assignments forward or creating new ones directly to colleagues as not acceptable. The possibilities of new work practices, for example with ad-hoc, mobile reporting and editorial teams, where the roles and responsibilities could be mixed and traditional teams could in fact vanish from existence were not mentioned by participants. As described in the Background section, reporting could at extreme shift to being more like material gathering at the scene of a happening and "drip-feeding" pieces to the newsroom where actual stories would be created from these pieces to emerging online stories.

Locationing is acceptable on agreed terms and if it does not threaten safety. Both the newsroom and the reporters in the field can benefit from locationing, not only when location-based news reporting assignments are used. The reporter may feel safer if he/she is tracked in a dangerous area. On the other hand, misuse of location information by outsiders may compromise the safety of the reporter as well as the anonymity of the informant in certain countries. As earlier studies suggest user initiated control for locationing and its preciseness is required. In addition, the consent and terms of when to allow locationing need to be agreed on.

Mobile assignments are suitable and cost-effective when briefing small, relatively simple stories and for fast reporting situations. However, they were perceived inefficient in communication compared to phone calls especially if further information or clarification is needed. It also seems that communicating the goals and perspectives of reporting are more challenging especially if the topic or story to be covered is large and can take multiple perspectives. If crowdsourcing, that is, using the audience as a means to carry out news reporting tasks, is considered to require similar activity, complexity and creativity [20] in carrying out complete assignments as with professionals, the needs and challenges regarding the mobile process and news briefings are likely to be similar to professionals. Structured information content and contextual information on the type of the story may be useful for them as well. However, at the moment the mobile assignments to reader reporters are in most cases relatively simple, usually asking for photos (see Tackable, and [28]). For crowdsourcing of complex and interdependent tasks in micro-task markets, such as MechanicalTurk, Kittur et al. [14] propose a solution called CrowdForge that enables task partitioning. They demonstrate successfully its use in two types of article writing: an encyclopedia article on New York city and in turning a scientific article into a popular press article. Further studies are needed in the case of crowdsourced news reporting on task complexity and needed creativity affecting task formulation and the ways to carry out news reporting tasks, as well as on the quality of contributions.

Limitations and future work. As the first limitation, the participants were students and the studies were carried out in university course settings. Although deadlines for reporting, for example, were set in addition to assigning news tasks to be carried out in realistic mobile news reporting situations, the real context of news reporting would reveal aspects that cannot be created in the current settings. Second, adopting the mobile and location-based assignments into use in a news organization and carrying out a longitudinal study would give firmer evidence on the perceptions, suitability and development needs. Future studies in the context of news journalism could address 1) freelancers and crowdsourcing as potential cases for mobile news assignments: in our studies, contract and rewarding related issues, for example, were not covered, 2) new emerging work practices and workflows with new mobile technologies, 3) impacts on roles and responsibilities of reporters and newsroom staff, 4) new types of news reporting and publishing enabled by mobile technology and 5) further studies on mobile assignments, that may require creativity, may not have clear completion criteria or criteria are situationally bounded.

CONCLUSIONS

We presented results from two user studies which explored the users' perceptions and needs as well as challenges when using mobile assignments in briefing news to cover. We found that mobile assignments sent to mobile phones were perceived as useful for small and simple assignments, whereas for more complex and larger themes they were found inefficient due to the lack of a possibility for discussing the topic. The information in the assignment description needs to be paid attention to in order to provide enough relevant information for the reporter to carry out the work and to take into account the mobility of the users and limitations for example in the size of the display for UI design. Both editors and reporters need process phase related information and updates on the phase, progress and further actions in the assignment and reporting process. Locationing was found somewhat acceptable, although privacy related concerns were expressed.

The findings of the study are applicable not only in a news reporting context, but in other fields of work where tasks may be complex, not strictly limited or completion may depend on situational issues. In addition, the results on, for example, process related issues may be applicable also to fields where "pro-ams" (professional amateurs) are carrying out assignments and participating in crowdsourcing, such as reader reporters in a news context [28].

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Paper 8

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Crowdsourced News Reporting – Supporting News Content Creation with Mobile Phones

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ABSTRACT
As news organizations are moving towards systematically using the power of crowds in news reporting, mobile phones are potential mobile tools for reader reporters. We conducted two user studies to support the development of future mobile crowdsourcing processes and mobile tools for news reporting. In a quasi-experiment on future mobile crowdsourcing process with location-based assignments, SMS messages were experienced as an easy and handy means for news assignments. A customized mobile client prototype was preferred for submission of multimedia content (photo and video), since submission was experienced simple to use and reliable especially for videos. Based on our findings and earlier research we discuss implications for the development of mobile crowdsourcing processes with mobile news reporting assignments.

Author Keywords
News, reader, location, crowdsourcing, mobile phone, task.

ACM Classification Keywords
H5.3. **[Group and Organizational Interfaces]**: Collaborative computing, Evaluation/Methodology, Organizational design. H5.2 **[User Interfaces]**

General Terms
Design, Experimentation, Human Factors.

INTRODUCTION
News organizations are increasingly receiving and using user-generated content (UGC), that is, photos, videos and stories, from their readers. Contents submitted by readers are nowadays used in many sections of the media websites from news comments or posts to free blog services and *send us your photos* – types of publishing. UGC can be used in various ways: as news as such, as a source of news or fresh ideas for news reporting, or getting new insights to various topics from a wider viewpoint. The mainstream journalistic institutions have used UGC so far quite cautiously. Comparative research has shown that journalistic institutions like to retain their traditional gatekeeping role in adopting user content on their websites [5,8].

However, some news organizations are not only waiting for what readers contribute, but moving towards more systematic recruiting of readers as registered reader reporters and asking for content on specific themes. For example CNN recruits so called iReporters[1] and provides an assignment desk online and in the mobile client for generic themes that CNN is interested in at a certain moment. There are also attempts to mobilize the audience to take part in the process of investigative journalism in which reporting networks of citizen journalists collaborate with the newsroom as in the case of ProPublica[2]. Reader participation, where readers contribute news content and the process is facilitated by the news organization, is one form of crowdsourcing.

Crowdsourcing means that problems or tasks that need solving are distributed to a crowd to be completed [1,10,24]. In news coverage, tasks, or news assignments, can be for example simple, small tasks like taking photos or videos, or more investigative reporting type of tasks. Mobile phones enable not only capturing and submitting of news content, but provide a means to connect and communicate directly with reader reporters wherever they are in various ways (for example SMS, dedicated mobile clients, email, social media like Facebook and Twitter). In addition, since reader reporters' mobile phones can be located with base station based locating or with GPS technology, the location information can be used for sending location-based news reporting assignments to their mobile phones. Therefore, mobile phones support the idea of mobile crowdsourcing [1,6,24] also in the context of news content co-creation.

Omakaupunki.fi[3] is a Finnish news site that combines the local content of Helsingin Sanomat news publication and two free tabloids Vartti and Metro published in Helsinki metropolitan area. Both tabloids are publishing thousands

MobileHCI 2011, Aug 30–Sept 2, 2011, Stockholm, Sweden.

[1] http://ireport.cnn.com/
[2] http://www.propublica.org/ion/reporting-network
[3] http://omakaupunki.hs.fi/puskaradio/

of photos from readers yearly on their pages and Omakaupunki.fi website receives about 20 000 photos a year from readers. Almost all of the photos are currently sent with MMS (mobile multimedia) messages to the newsroom. Using MMS message as the submission solution limits the possibility of sending higher quality photos and even more importantly submission of videos to be published as news content. The publisher, Sanoma Kaupunkilehdet, is developing the citizen reporter concept further as part of Finnish Next Media research programme.

To support the development of the future mobile crowdsourcing processes and related mobile tools for news reporting, we conducted two user studies. We first made a study with nine reader reporters of Omakaupunki.fi asking for their experiences of mobile phones as a tool for photo content production in the current mobile content creation process. Second, we conducted a quasi-experiment with 19 participants in mobile context to evaluate users' experiences of using mobile phones as tools in a future mobile crowdsourcing process using mobile, location-based assignments. Only few earlier studies [1,12] report users' experiences in location-based crowdsourcing.

We start with an overview of the background of the study and related research. Second, we describe results from the preliminary study on reader reporter's experiences on using mobile phones in one of the current mobile news co-creation processes. Third, we describe the evaluation and report results of a quasi-experiment in field conditions. Within the experiment we tested a novel location-based crowdsourcing process and a mobile client prototype for mobile photo and video content creation and submission. We conclude with a discussion and future work.

BACKGROUND AND RELATED WORK

In this section we discuss user-generated content and crowdsourcing, especially in news journalism.

User-Generated Content in news journalism

User-Generated Content (UGC) in news journalism has at least three origins. The first is technological: broadband connections and mobile devices have disseminated the use of interactive technology to masses. The second is economical: traditional media, especially newspaper industry is facing decreasing revenues and readership which intensifies the search after new production models [17]. In this context UGC is seen as a cost-effective way to collect interesting and also journalistically relevant material. The third is cultural: the rise of social media platforms has shown that people want to create and share their content with others. This trend has potential also when thinking of journalism.

To what extent newsrooms are use content sent by reader reporters, has been categorized by Tomaiulo [23] into four groups. Reader reporters' content can be 1) the main source of news content, 2) at larger news sites part of the content, 3) at news sites focusing on local news part of the content or 4) the only content based on reader reporters' own categorization. Omakaupunki.fi falls into the third category.

When readers contribute UGC to the news, the themes typically cover 1) newsworthy events, such as accidents or natural disasters, 2) an incident in everyday life, for example funny or out of ordinary, as well as 3) nature and animals, such as beautiful landscapes. Pantti and Bakker [20] call these three groups as misfortunes, memories and sunsets in case of photos contributed by readers.

The current tools for mobile news content creation and submissions are often based on traditional processes, that is, capturing content with the mobile phone's default camera applications and sending content via Multimedia Messaging Service (MMS) or email (see e.g. BBC News Have Your Say[4]). Some customized mobile applications are provided in which content submission from mobile devices is enabled. For example, there are iPhone and Android client applications for news publishers such as CNN, Miami Herald, and ProPublica as well as Fix My Street[5] for reporting things to fix or Shozu at NowPublic[6] which relies on user-generated content entirely. In addition, applications developed originally as social media for sharing content such as photos, have been utilized as well, like Yahoo! "Your Witness" News users Flickr as a source for UGC.

These cases exemplify technological solutions that support users to submit their own content. However, it seems that most of the mobile tools support users to send and share their content and tip-offs with newsrooms. Only a few specialized tools for mobile phones, such as Need4Feed[7] or the mobile news client of CNN, support newsrooms to contact reader reporters and distribute requests to reader reporters to send content on a wanted topic. One of the recent developments is Scoopshot[8], which is an Internet market place (intermediary) that provides audience with a mobile client application for submitting content to the marketplace. Submission can be done on own initiative or by answering to a t ask sent to the service. Scoopshot therefore offers news organizations one way of getting and buying content created by the readers.

Our aim is to explore the entire process of mobile crowdsourcing covering mobile assignments, collecting the material as well as submitting - all phases with mobile phones as enabling tools for reader reporting.

Crowdsourcing in news journalism

Dan Gillmor stated in his book *We the media* already in 2004 reason why journalists should take their audience

[4] http://www.bbc.co.uk/news/help-10801499
[5] http://www.fixmystreet.com/faq
[6] http://www.nowpublic.com/newsroom/tools/shozu
[7] http://www.newelo.com/Need4Feed
[8] https://www.scoopshot.com/wp/fi/ohjeita/

more seriously - simply because readers usually know more than a single journalist does [7]. UGC can be used in a more crowdsourced manner like for example in collaborative reporting. This means that readers are contributing in the making of a story by sharing their expertise with the journalist, asking questions and providing guidance to the journalist or in some cases even doing the actual reporting [19].

This kind of collaboration can develop into more formal models of crowsourcing as the example of CNN's iReport shows. In the studied case of Omakaupunki.fi the collaboration can be based not only on current main stream practice of user initiated, ad-hoc reporting. Calls for content can be for example 1) coordinated calls to the crowd for certain content requested by the media organization (like photos on a certain theme) or 2) focused calls, commissions or assignments for content to one or several reader reporters based on their profile, specific expertise or geographic location.

Several mobile crowdsourcing tools and platforms have been proposed in research literature, such as *txteagle* [6], *Askus* [12], and *mCrowd* [24]. *Askus* developed by Konomi et al. [12] uses not only task and its set location information in finding potential crowd workers, but also includes solver's status information, like busy or available, when choosing potential crowd workers. Alt et al. [1] developed and evaluated a platform for mobile location-based crowdsourcing, which enables usage of location information of the tasks, as well as of the solvers in the crowdsourcing process. Alt et al. found that pulling tasks was preferred to pushing, and requests for photos were most preferred tasks. Following questions arise from these findings related to using mobile crowdsourcing in news reporting: 1) how and with what means reader reporters would like to get the mobile assignments and 2) what kind of mobile assignments they are willing to undertake and in what situations. In this paper we look at the first question and specifically explore how SMS messages that were planned by the news publisher to be used as a way of delivering mobile assignments to reader reporters fit the mobile news reporting process in field conditions.

On the other hand, the solvers' strategies of solving problems in crowdsourcing communities have been reported [25] as well as the relationship between incentives and participation [4]. When mobile assignments are taken into use in crowdsourced news reporting, both of these issues are expected to be relevant when planning the mobile assignment processes. We do not specifically explore these aspects in our studies, but they emerge in the collected data.

STUDY 1. STUDY ON CURRENT MOBILE PROCESS

We first conducted a user study with nine reader reporters of Omakaupunki.fi, Vartti and Metro. One of the interview themes was real-life experiences of using mobile phones in capturing and submitting photos to the news publication. We focus here on these results.

The mobile content co-creation process at the time of the study was primarily based on capturing and submitting newsworthy material based on reader's own initiative. The news publisher promotes MMS messages to the newsroom number as the means of submission for readers' photo content. Publisher pays for photo content published in the print publication a reward as vouchers to movies or monetary rewards up to a 1000 euros. Most common rewards are at maximum 50 euros in value.

Research method

Study setup

Nine reader reporters were recruited by a journalist working in the local news publication in fall 2010. Their photos had been previously published in online and printed versions of the news publication. Six participants were interviewed and three answered the same questions through an online questionnaire. Both closed and open-ended questions were used. Participants were compensated for their participation with two vouchers to movies (value 17 euros).

Participants

Five participants were aged between 51-60 years, and four between 16-39 years. Four participants were female and five male. Highest educational degrees varied between elementary school and a bachelor's degree.

Participants reported as the frequency of using mobile phones for photo capture to be weekly (4), monthly (3), less than monthly (1) and never (1, instead used a super-zoom camera). Mobile phones were used infrequently for video capture, since most participants who captured videos reported as the frequency as less than monthly (4), one weekly and one monthly. Majority of participants reported as their activity of submitting photos to local news publication during last half a year 2-5 times (6), but none had submitted videos. Eight participants had submitted their photos with MMS messages, but also email (2) and web-site submission (1) were mentioned.

Motivations to participate

We found three main motivating factors to send photos. The most often mentioned motivator was a monetary fee, usually 50, sometimes 100 euros paid for the photos published on the printed versions of Metro and Vartti. Other important motivating factors were sharing one's photos with others and informing wider public about local issues.

Analysis

Qualitative data-driven content analysis was used for open questions. We used open coding for emerging themes and as the analysis progressed, we fixed the coding and grouped codes under higher level categories.

Results

Mobile phone is not always satisfactory enough for photographing

Although a mobile phone was in general found non-problematic in capturing photos, technology related restrictions were mentioned by some participants. In addition, some participants discussed the visual appearance and composition as important aspects of the photos. These participants also mentioned the limitations in the technical quality of photos taken with the mobile phone, especially in relation to contrast and lighting. The technological limitations prohibited in some cases capturing what the reader reporter would have wanted to share with others and therefore the submission of content.

Choosing what to submit

Some participants noted that they submitted only material, that they sensed to be newsworthy or somehow capturing. They also explicitly mentioned that they found it worthwhile to send only material that they expected to have a chance to be published in print and therefore getting rewarded. This seems to indicate, that when participating is more active, participants develop strategies and learn what kind of material is worth submitting. In addition, since sending MMS messages to the newsroom's number is a cost to the sender, this may also support selective submission behaviour. Our finding reflects the findings by Yang et al. [25] who found that those participating into crowdsourcing activities develop strategies aiming to maximize the chance of reward and minimizing effort.

MMS message – an easy and convenient means for photo submission

The submission of photos with an MMS message to the newsroom number was found easy and convenient by all participants who had used this submission method. The only mentioned problem was the extra cost related to sending MMS messages to the newsroom's number. The feedback for the received MMS message was experienced to be fast.

The fundamental facts about an event may be missing from the MMS message

One emerging theme is the text participants add to the MMS messages. Especially those who were more active contributors (more than 3 times in last half a year) mentioned that they added text on questions related to "*what, where, when - reasons, incidents and consequences"* as explicitly described by one interviewee. These are the fundamental facts to be answered when reporting news and also asked by the news organization to be attached to the MMS message. However, participants mentioned that in some cases photos were also sent with no explanatory text at all. No explicit reason was given for this by the participants, but some described that instead of writing text in the heat of an event, such as a demonstration, they expect the newsroom staff to ask for more information with a phone call if the topic is interesting enough.

Reward not received is remembered

As mentioned previously, rewarding for a good photo was mentioned as an important motivational factor. Reward also acts as an reinforcement. Whenever a participant had experienced some problems in receiving the promised reward, he/she clearly emphasized dissatisfaction.

STUDY 2. QUASI-EXPERIMENT IN FIELD CONDITIONS

To support the development of future mobile crowdsourcing processes and mobile applications for news content co-creation, we conducted a quasi-experiment in field conditions [11,18]. In the experiment we studied mobile users' experiences of 1) a future mobile assignment process with location-based assignments sent with text messages (SMS), 2) multimedia capture and 3) submission of captured content. Within the experiment we tested a mobile client prototype for creation and submission of user-generated photo and video content intended for mobile news co-creation process.

We first describe the mobile client prototype, followed by research method and finally present results.

Prototype for producing user-generated content

A prototype system for photo and video capture and uploading was developed for the future mobile news co-creation process. This system contains three components: a mobile client for video and photo capture and content uploading (called OKReportteri), a backend service to store uploaded content and a standard browser to browse the uploaded content. The backend service is implemented in a server equipped with Linux operating system, Apache web server, PHP processor module and MySQL database. The role of backend service is twofold: 1) Receive and store uploaded content and 2) Provide access to the content. A standard web browser can be used to browse through the files uploaded and display metadata from the database.

The OKReportteri mobile client was developed for Android platform (release 2.1) using Java. The user interface language is Finnish. Main functionalities of the mobile client are: 1) Register a user by storing a phone number and a nickname, 2) Take a photo using device's native camera application, 3) Record video using a simplified video recording utility, 4) After a photo or a video has been recorded, location information is captured in two phases - network based location is captured always and GPS based location only if user agrees, due to privacy reasons and being more time consuming. 5) Browse photos and videos 6) Delete photos and videos. 7) Upload multimedia and respective metadata (location, phone number and nickname) over the WLAN or cellular network. WLAN is used if possible. If WLAN is not available then packed data of cellular network is used instead.

Figure 1 illustrates the main menu (tabs from left to right: "Photo", "Video" and "End") and the selection menu for photo related functionalities (tabs on top row: "Take a photo", "Browse photos", bottom row: "Send a photo", "Delete a photo", "Main menu"). The selection menu for video functionalities is similar to photos.

Figure 1. OKReportteri's main menu (left) and selection menu for photo functionalities (right).

Research method

Design

A quasi-experiment in field conditions was used to evaluate the mobile tools and the mobile co-creation process in a realistic context. An experimental setup was used to obtain a quantitative comparison of the mobile client prototype, OKReportteri, against the currently available and used phone functionalities for capturing of multimedia and MMS (multimedia message) based submission. Four test conditions were created based on combinations of used applications for photo and video capture with submission applications (see Table 1). In all test conditions the location-based assignments were sent with SMS messages. A within-subjects design was used and the order of the test conditions was pseudo-randomly counterbalanced.

Cond.	Content	Capture	Submission
A	Photo	Phone func.	MMS
B	Video	Phone func.	MMS
C	Photo	OKReportteri	OKReportteri
D	Video	OKReportteri	OKReportteri

Table 1. Test conditions (SMS messages used for location-based assignments in all conditions).

Tasks

All participants were sent four mobile reporting assignments to be conducted as test tasks. Messages indicated that participant's location was known to the sender on an approximate level and a specific type of content (photo or video) was asked for specified topics (see Table 2).

Each individual task (mobile reporting assignment) consisted of three subtasks: 1) *Reading* the assignment (SMS), 2) *Capturing* a photo or a video clip for the assignment either with phone functionality or with OKReportteri mobile client, and 3) *Submitting* captured material either with MMS message to the newsroom phone number or with OKReportteri directly to the server.

Task	Topic	Indicated location
1	Weather	Close to central square
2	Typical town scenery	Close to pedestrian street
3	Something needing fixing in cityscape	Downtown
4	Tree in cityscape	Close to the boulevard

Table 2. Reporting assignments with location (SMS messages used for location-based assignments in all conditions).

Dependent variables - User experience related measures

We applied the framework for user experience components presented by Mahlke et al. [15] for user experience measures. We included interaction characteristics, instrumental qualities, emotional user reactions and consequences of user experience [14, 15] as components.

Interaction characteristics were measured with time on task covering total time used for completing the assignment. Time on task covers all three subtasks (reading assignment, capturing and submitting multimedia) and walking while conducting the assignment. It was timed by the experimenter with a stop watch. In addition, during each test task, an objective measure was collected as a binary task completion of individual subtasks (read, capture, send) by the experimenter [9].

Instrumental qualities were measured with two items from the After-Scenario Questionnaire (ASQ) [13] on satisfaction with the ease of and the amount of time to complete each of the three subtasks – reading SMS assignment, capturing photo or video and submitting the material [9, 21, 22]. A 7-point Likert scale was used in assessment (1=strongly disagree, 7=strongly agree).

Affective experiences associated with emotional user reactions to using the mobile system were measured with SAM (Self-Assessment Manikin) with two nine point scales, that is, valence (1=positive, 5=neutral, 9=negative) and arousal (1=excited, 5=neutral, 9=peaceful, calm) [2]. In addition, the intrinsic pleasantness (see e.g. [14]) of mobile system use was measured with a 7-point Likert scale (1=strongly disagree, 7=strongly agree).

As a consequence of user experience a rating for overall easiness of mobile system use was measured [21,22]. In addition, participants were asked in the post-test interview for their application preference for photo and video capture as well as for submission [9].

Participants

Nineteen (19) participants participated in the field experiment (12 female, 7 male). They were recruited through email lists in a higher vocational school and a university and by an advertisement on internal web pages of a university of technology. Participants' average age was 28.5 years (min=20, max=61, Mdn=24, SD=10.8).

Majority of the users (15) used at the time of the test a mobile phone by Nokia (1 iPhone user, 1 LG user, 2 Samsung users). Five participants had in their current or previous mobile phone a touch screen. Participants' frequency of photo capture with mobile phones was weekly or less frequent. Only one participant captured videos with a mobile phone weekly, most participants monthly or less frequently. Two participants did not use a mobile phone for capturing photos and two for capturing videos. Ten participants had prior experience of using a mobile phone for sending or sharing photos or videos to others. Three participants had prior experience of sending reader's photos or videos to newspapers.

Procedure

In the pre-test session indoors in a cafe, the affective experience scales were first explained to the participant, followed by demographic data collection. After this the participants were asked to rate their affective experience with the SAM scales. Next the training of phone and application usage took place. After training the participants were asked to rate their affective state and intrinsic pleasantness of mobile system use.

In the test-sessions in mobile context, prior to each task, the location-based reporting assignment was sent to the mobile phone used in the test from experimenter's "newsroom" phone. Immediately after completing each of the four tasks, participants' rated user experience related measures.

In post-test session, participants were first interviewed on their experiences of mobile system usage and mobile process. After the interview, they were asked to fill in a questionnaire on privacy preferences and concerns. The results related to privacy issues are reported elsewhere.

Apparatus

The mobile phone used in the experiment was HTC Legend. The mobile client tested was version v2.1 of OKReportteri. The main functionalities of OKReportteri that were used in the experiment were capturing, browsing and selecting of captured content, and submitting of photos and videos. The quality of the captured photos was set to normal, resolution was 640x416, ISO 400. The quality of the captured videos was set to QVGA 320x420 and it was recorded with audio. OKReportteri used the available cellular connection for content submission. The used phone functionalities are presented in Table 1.

Context of the experiment

Field experiment of the OKReportteri mobile service was carried out by one experimenter during November-December 2010 in Finland. Experiment was situated primarily in pedestrian areas to limit the safety risks of the participants. The weather conditions were typical for Finnish winters, temperatures from below 0 degrees Celsius to -15 degrees Celsius. Tests were held primarily between 10 am and 7 pm. In Finland the sun sets around 3-4 pm at the time of the tests, so that the evening tests were held in urban city center lighting.

Analysis

We analyzed the test data by non-parametric methods due to the small number of participants and most distributions not being Gaussian. Wilcoxon's matched pairs signed ranks tests were used in pair-wise comparisons between the two photo conditions (A and C) and two video conditions (B and D). Missing variable values were excluded from statistical analysis. In addition, we analyzed the transcribed post-test interviews with NVivo8, using data-driven content analysis and applying first open coding, and then fixing the coding and categorizing into higher level categories.

Results

Following subsections describe results of the user experience related measures based on the test conditions and by comparing the two conditions for photo and video production.

SMS based assignments

All participants succeeded in reading SMS based assignments in all test conditions. We tested for all test conditions the satisfaction with the easiness of reading and time used for reading with Friedman's two-way analysis of variance. Since no significant differences were found between the test conditions, we calculated the satisfaction ratings by combining results from all test conditions. Participants were on average satisfied with the easiness of reading the assignment (min=1, max=7, Mdn=6, M=5.47, SD=1.07). Similarly, they were satisfied with the time used for reading the assignment (min=3, max=7, Mdn=6, M=5.67, SD=0.52). Therefore, SMS message seems from the point of view of basic usability as one feasible way to reach reader reporters when sending mobile assignments.

Pair-wise comparisons

Pair-wise tests with Wilcoxon signed-rank test were conducted for condition pairs A and C for photo content, and B and D for video content. We exclude other pair-wise comparisons from the results since we were specifically interested in comparing results of two conditions with each other related to photo and video content production tools and processes. Preferences for photo and video content capture and submission are also presented.

Comparing conditions A and C for photo content. The satisfaction with time used for photo capture with phone

camera was significantly higher (Cond. A, min=4, max=7, Mdn=6, M=5.67, SD=0.84) than with OKReportteri (Cond. C, min=2, max=7, Mdn=6, M=4.89, SD=1.78), z=1.98, p<.05. This result reflects the findings from the interviews, in which several participants comment that using the phone camera directly is faster than in OKReportteri, in which several selections need to be done within the menu structure before one can start capturing a photo.

Affective experiences for arousal (1= excited, 9=calm) were rated as significantly higher when using OKReportteri for photo capture and submission (Cond. C, min=2, max=9, Mdn=5, M=5.21, SD=1.90) than when using phone camera and MMS submission for photos (Cond. A, min=3, max=9, Mdn=5, M=5.84, SD=1.54), z=2.03, p<.05. No explanation can be found for this finding based on the collected data.

	Cond. A (phone func. + MMS)		**Cond. C (OKReportteri)**	
Dependent variables	**M**	**SD**	**M**	**SD**
No. of completed subtasks (0-3)	2.95	.229	2.89	0.46
*Time on task (s)	288.5	113.3	282.7	110.6
*Capture – Easiness	5.78	0.73	5.94	1.16
*Capture–Used time	5.67	0.84	4.89	1.78
*Submit – Easiness	4.83	1.47	5.61	1.58
*Submit -Used time	5.11	1.32	5.33	1.78
SAM valence	3.37	1.21	2.89	1.97
SAM arousal	5.84	1.54	5.21	1.90
Pleasantness	5.42	1.12	5.68	0.95
Overall easiness	5.47	1.22	6.05	0.78

*N=18, for other variables N=19.

Table 3. Mean and standard deviation of dependent variables in conditions A and C for photo capture and submission.

The ratings for the overall easiness of using the mobile system were significantly higher when using OKReportteri for photo capture and submission (Cond. C, min=4, max=7, Mdn=6, M=6.05, SD=0.78) than when using phone camera for photo capture and MMS for photo submission (Cond. A, min=3, max=7, Mdn=6, M=5.47, SD=1.22), z=2.50, p<0.05. Post-test interview data revealed that participants found the interaction with the camera and messaging functionalities of the phone somewhat difficult to use. On the contrary, interaction with OKReportteri was found simple due to its simple menu structure.

Preference for photo capture and submission. Table 4 presents the preferences for photo capture and submission based on post-test interviews.

When asked for the preference for photo capture seven (7) participants stated that their preference depends on whether they are deliberately reporting news or capturing photos for their own use. One of the main reasons mentioned for choosing OKReportteri was that it was found straightforward to use if one would know prior to capturing to be sending the photos to the newsroom. On the other hand, participants stated that photo capture with the phone camera functionality was faster due to being able to start capturing with one button. Furthermore, using phone camera functionality was mentioned to enable directly moving between photo and video capture modes if needed, in contrast to OKReportteri which would require navigation through several steps in the menus.

OKReportteri was clearly preferred (16/19) for photo submission in the case of news reporting. The main reasons mentioned by participants when choosing OKReportteri were the easiness of sending directly to server instead of having to choose a contact for the MMS submission, getting clear feedback for the submission and therefore being seemingly a more "reliable" solution.

	Photo capture	**Photo submission**
Phone func. (camera/MMS)	7	2
OKReportteri	4	16
Undecided	1	1
Situation dependent*	7	-

*OKReportteri if news reporting, else phone camera.

Table 4. Preferences for photo capture and submission.

Comparing conditions B and D for video content. The number of completed subtasks is significantly higher when using OKReportteri for video submission and capture (M=3, SD=0.00) than when using phone functionality and MMS (min=2, max=3, Mdn=2, M=2.26, SD=0.45) z=3.74, p<.001. This difference is natural due to the fact that subtask on video submission with MMS was completed only by 5/19 participants.

For video submission, the satisfaction with easiness of submission with OKReportteri was significantly higher (Cond. D, min=3, max=7, Mdn=6, M=5.56) than with MMS (Cond. B, min=1, max=7, Mdn=3, M=3.17), z=3.40, p<.01. Similarly to the previous finding this could be explained by the fact that majority of participants (14/19) did not succeed in submission of videos with MMS message.

Preference for video capture and submission. Table 6 presents the preferences for video capture and submission based on the post-test interviews. On the contrary to photo capture, most participants (12/19) preferred using phone camera functionality for video capture. Reasons mentioned

were primarily related to the user interface of OKReportteri for video captures. Main reasons mentioned were that the video functionality of OKReportteri was missing a timer for video capture, and functionalities such as zooming as well as the interaction by starting and stopping capture with a software button on the user interface was found cumbersome.

	Cond. B (Phone func. + MMS)		Cond. D (OKReportteri)	
	M	**SD**	**M**	**SD**
No. of completed sub-tasks (0-3)	2.26	0.45	3	0.00
*Time on task	347.2	94.6	320.5	95.8
*Capture – Easiness	5.67	1.19	5.06	1.31
*Capture –Used time	5.61	1.15	5.33	1.24
*Submit – Easiness	3.17	1.72	5.56	1.15
*Submit – Used time	3.67	1.78	4.67	1.78
SAM valence	5.11	1.97	3.74	1.59
SAM arousal	5.00	1.47	5.58	1.61
Pleasantness	4.53	1.47	5.21	1.13
Overall easiness	4.84	1.34	5.53	1.17

*N=18, for other variables N=19.

Table 5. Mean and standard deviation of dependent variables in conditions B and D for video capture and submission.

	Video capture	Video submission
Phone func. (camera/MMS)	12	-
OKReportteri	4	18
Undecided	1	1
Situation dependent*	2	-

*OKReportteri if news reporting, else phone camera.

Table 6. Preferences for video capture and submission.

On the other hand, OKReportteri was clearly preferred for video submission (18/19). Participants mentioned as the reason for their preference the problems they faced with the MMS submission.

Perceptions of mobile assignments

In the post-test interviews, participants were asked about their experiences and perceptions of the mobile assignments in the mobile crowdsourcing process. Majority of the participants (13/19) perceived the mobile assignments positively, specifically describing them with positive attributes. SMS assignments related to news reporting were described to be "*easy*", "*simple*", "*handy*", "*logical*" and "*well suited for street situations, since no separate paper is needed*". Three participants mentioned that they needed to read the SMS assignments twice to remember the assignment, first when they received it and second time right before starting to carry out the assignment. Negative comments were primarily related to problems in the interaction, related to not having earlier experience with a touch-screen mobile phone or not being familiar with the user interface implementation of the used test device.

Some participants wished for the wording of the assignments to be more personal. In addition, they mentioned that if the assignment is not personal, it feels that it has been sent to a lot of reader reporters and they would not undertake it, since they would assume that someone else will conduct it. Furthermore, it was indicated that the newsroom could appear as more human-like instead of a depersonalized organization. This was also clearly linked to locating of the reader reporters:

"Maybe wordings like if it is said that "the newsroom has received information" - it somehow brings apart. If it would say like "Hi, we have […]" … Newsroom would be talked about like people and not like "newsroom has received information"- like someone is monitoring me and then, would send secret messages that now he is there." P2-14

Participants mentioned following benefits for reader reporters in case of location-based mobile assignments. First, location-based assignments give a possibility to report something that the newsroom is interested in. Second, they enable getting a reward for reporting. Third, if one does not him/herself spot something newsworthy when close-by, the newsroom can tip-off the reporter. Drawbacks that spontaneously were raised by interviewees were privacy related issues, which are discussed in detail elsewhere.

For the newsroom several benefits were mentioned by participants when using locating and location-based assignments. The most often mentioned benefit was that the newsroom could locate a reader reporter close-by to a place, where something is happening and needs reporting. Furthermore, it was mentioned that the newsroom gets content faster than by traditional journalistic process, in which a professional is sent to the scene, and news reporting speeds up in general. In addition, the authenticity of the material when utilizing locating was mentioned to be more reliable.

DISCUSSION

Based on our findings and earlier research we discuss issues related to planning of mobile crowdsourcing processes when mobile phones are the enabling tools for mobile news content production. Our focus here is on the mobile news reporting assignments that are sent to the reader reporters.

Choosing the right means to reach the crowd. Based on our findings, SMS messages seem a feasible way of sending mobile assignments to the reader reporters. However, also email, customized mobile applications or services, social media like Facebook and Twitter, an intermediary, such as Scoopshot or even "traditional" crowsourcing communities, such as Mechanical Turk could be utilized. Choice of the channel may depend on the type of tasks or assignments, type of content and the "crowd" that wants to be reached – whether one or few experts or reporters is enough, or is a wider group want to be reached for content generation and participation. On the other hand, news publishers may have and want to maintain a special relationship with their reader reporters, and therefore direct contact under publisher's own brand (such as CNN iReporters) may be preferred over using general purpose services or communities available for crowdsourcing.

Using profiling and locating of reader reporters. To support the using of mobile assignments, profiling as well as locating of reader reporters may be beneficial for finding potential reporters for the tasks. Profiles may be based on information given by a registered reader reporter, but on the other hand utilizing information on undertaken and accomplished tasks may be used as information for finding potential reporters. In addition, locating reader reporters may be used based on their current geolocation in case of a need for location dependent content and reporting in temporally fast paced or more generally time and place related reporting. This means that some solution for locating needs to be used by the newsroom and the permission to locate needs to be obtained from the reader reporters. From reader reporter's viewpoint locating is related to the need for controlling locating and availability as well as privacy issues, including trust in and relationship with the organization. Previous studies on location-based services report as key factors affecting privacy concerns for example what is the organization that utilizes the location information as well as the precision of locating and the reason for asking the information [3,16]. Privacy related findings from our studies are reported elsewhere.

Personalizing mobile assignments and making newsroom appear humane. Our findings seem to indicate, that personalizing mobile assignments and using active humane voice of newsroom journalists instead of referring to depersonalized newsroom in a passive tone, is important. These may have an effect on how reader reporters react to locating as well as their willingness to undertake assignments. However, the need for personalization and its effect may depend on the type of calls made for content – whether they are meant for a specific person alone, or for a larger group. Personalization of the assignment message could therefore be an indication for the reader reporter on the importance of his/her participation and whether others are involved. Using personalization in all mobile assignments could on the other hand lead to reader reporters becoming negligent towards assignments.

Supporting wise selection and undertaking of tasks. Reader reporters should get support on making decisions on what tasks to undertake and what to reject. This could be for example information within the mobile assignment whether the task is sent to a wider group or only to a few persons or at extreme only to him/herself to gain an understanding of their chances of succeeding and supporting motivational aspects. Alternatively, if the task is not extremely time critical nor compulsory to report, on the contrary to the case of reporting for example a fire close-by, solutions for assigning a task to oneself could be provided like proposed by Alt et al. [1]. From the point of view of the newsroom, however, it may be preferable to get content from several reader reporters. This not only ensures the quality and multiple viewpoints to the incident or topic, but also makes sure, that content is received, if no binding contract for reporting is made in the crowdsourcing process.

Rewarding – essential for motivation. In our pre-study with current reader reporters, we found that getting a reward was an important motivational factor. Although we did not include rewarding into the research design of the quasi-experiment we conducted, rewarding came up spontaneously in the post-test interviews. It seems that when mobile assignments are sent to the reader reporters, assignments should provide information of the rewarding mechanisms used. Based on the rewarding mechanism, type of call for content (open, focused), their own interest and current situation and other information like deadlines, reader reporters can make strategic decisions [25] on whether to undertake the task or not.

Limitations of the study. First, in our first study the number of participants was low and included only reader reporters, who had been rewarded for their photos. Second, the assignments in the second study concentrated solely on photo or video content and asked for only one piece of certain content type to be captured and sent for each task. Third, the SMS assignments were simulated to be location-based, however, in reality we did not use locating. Instead, the SMS assignment indicated approximately the location we knew the participant is close to in the experiment. Fourth, in the quasi-experiment, the users did not have any temporal constraints, nor were the topics of the assignments covering any ad-hoc type of situations, with a demand for fast capturing of the "passing moment" or varying types of content. This may affect the measurements in the second study. Fifth, since the quasi-experiment was conducted in field conditions, it is not possible to control the environmental variables, such as temperature. Finally, since the mobile device used in the quasi-experiement was not familiar to participants, including the phone's user interface and interaction, this has an effect on the evaluation results. The described limitations may have an effect on the participant's assessments and they may limit the generalizability of the results.

CONCLUSION

We conducted two user studies to support the development of future mobile crowdsourcing processes and mobile tools for news reporting, when reader reporters are involved as crowd workers. In the first study on the current photo content creation process, reader reporters reported to be selective towards the material they send, aiming to be rewarded for their submitted content. In the second study on a future mobile crowdsourcing process with mobile assignments, SMS messages were experienced as an easy and handy means for receiving news assignments. The customized mobile client, OKReportteri, was preferred for multimedia (photo and video) submission, since it was experienced as simpler and more reliable to send material directly to the server, in contrast to MMS message, which failed for most participants in sending of videos.

In the discussion, we addressed following issues to be considered with related implementational aspects both from reader reporters' and news organization's viewpoint: 1) selecting the right means to reach the crowd, 2) applying profiling and locating, 3) personalizing assignments and appearing as a humane partner, 4) supporting reader reporters to make strategic decisions for undertaking tasks, and 5) indicating the rewarding mechanisms in the mobile assignments. Our future studies in news reporting address the usage and experiences of mobile and location-based assignments further in real-life field trials within news production process.

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Paper 9

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Location-Based Crowdsourcing of Hyperlocal News – Dimensions of Participation Preferences

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ABSTRACT
We studied the mobile users' preferences and concerns of using location-based assignments (LBA) and geotagging in crowdsourced news making. First, nine readers who had submitted reader's phtos were interviewed about their perceptions of LBA and geotagging scenarios. Second, a quasi-experiment in field conditions was carried out with nineteen participants. After completing four LBA tasks with a mobile phone, participants were interviewed on their perceptions and asked to complete a questionnaire on their preferences for receiving LBA and usage of geotags. Findings indicate that the perceived benefits of LBA and geotagging are greater than the perceived risks. The task type, temporal context, preciseness of location query, proximity to the reporting location, parallel tasks, social context and incentives affected the participation preferences. We propose a framework for participation preferences to support further studies in location-based crowdsourcing and in the development of crowdsourcing processes and systems.

Categories and Subject Descriptors
H.5.3 Computer-supported cooperative work.

Keywords
Crowdsourcing, location, privacy, news, assignment, user-generated content, UGC, reader.

1. INTRODUCTION
Crowdsourcing by using tasks [13] to get readers to contribute news content is one way to collaborate with the audience in news making [43]. It can strengthen the relationship between the participating audience and the newsroom in a new and fruitful way. Using readers' content is a cost-effective way of getting news content, story ideas or new angles to reporting [14][30] and to provide relevant a content for the audience [34][45].

Currently, news industry widely encourages readers to send photos and videos with their mobile phones. For example, a hyperlocal news provider in Helsinki metropolitan area in Finland received 2077 reader's photos in May 2012 and about 20,000 reader's photos in 2011. Majority of these photos were sent as MMS (multimedia) messages from mobile phones.

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This article focuses on the process of news content creation collaboratively with readers, who are recruited to collaborate in news making. We concentrate on location-based crowdsourcing, in which the initiator (news organization) sends a task or makes available a task based on the participant's (reader's) mobile phone location (location-based assignment, LBA) for voluntary undertaking using smartphones as an enabler for participation. In addition, we study the attitudes towards geotagging of news content and the use of geotags in news publishing.

In order to succeed in collaborating with the readers in the news making process, it is crucially important to understand what affects readers' willingness to participate and how they understand their position as collaborators in news making with media organisations. Since the role of location information is rapidly increasing in importance in the news media, information that aids in the development of the collaborative news making processes is needed. Furthermore, using everyday technology such as smartphones as tools has great potential especially in the field of hyperlocal journalism where community reporters are recruited for voluntary work. However, location information is considered as private [17][29][40]. Therefore we need to investigate how its use is perceived by readers who participate in news making.

Only a few user studies exist on using a mobile phone's location information in crowdsourcing with tasks [1][43] or on using location-based assignments in news making [42][43], although mobile tools for crowdsourcing have been developed and reported [12],[23],[47]. Especially how readers perceive 1) the usage of their location information for location-based assignments sent by the newsroom and 2) geotagging of the news content they generate as well as 3) what their preferences in these cases are have received little attention.

This paper addresses these issues by presenting results from two user studies. Research questions are: **RQ1.** What affects mobile users' participation preferences in location-based crowdsourcing with LBA that is facilitated by a news organization? **RQ2.** How do users perceive the risks of sharing their location information in the context of news making?

The paper presents the following contributions:
- Framework for the dimensions of readers' preferences to participate in location-based crowdsourcing processes and
- Implications derived from the findings to aid in developing location-based mobile crowdsourcing processes for news.

2. BACKGROUND AND RELATED WORK
2.1 Crowdsourcing in news making
The idea behind the term crowdsourcing has its origins in the notions about the wisdom of the crowds [16],[36] as well as in collaborative creation and production [16],[38]. In addition to using microtasks that can contribute to a larger problem to be

solved [22],[33], crowdsourcing is used in fields requiring specific domain knowledge, expertise or creative skills. Examples include open source software development [38], open innovation [2],[35], eScience [5], and citizen or participatory journalism [34],[45]. In this paper we focus on participatory journalism in which readers or volunteers participate in news making that is facilitated and managed by a news organization [34].

The progress of collaboration with the audience in news journalism has been rather slow despite strong advocates of participatory journalism and collaboration with the audience [4], [11],[14],[30]. There are only few newsrooms in the world that have experimented with opening their whole work process from selecting the news topics to editing and distributing the content to the audience. Usually professional journalists in traditional news organizations are still keeping the decision making power at each stage of the news production to themselves [34].

Most explorative, collaborative and open processes in news making are usually found outside the traditional newsrooms. Typically volunteer contributors are not compensated for their participation in these models. For example, ProPublica[1] has trialed an advanced process for collaboration with volunteers in investigative reporting based on a reporting network which reports on given investigative tasks. ProPublica also taps into the specific domain knowledge of the network members as sources or experts on specific themes under investigation (see also [6]). However, similarly to OhmyNews[2] and Huffington Post[3], which are news sites for citizen journalism, professionals still facilitate and manage to varying extent the participation of the volunteers to news making, even in cases in which volunteers act in the role of content curators [7],[34].

2.2 Types of collaboration in news making

To link the crowdsourcing to different types of collaboration between the participating readers or volunteers and the newsroom, we apply here the categorization of citizen science projects [5]. Bonney et al. [5] describe three categories of co-operation between volunteers and scientists: 1) *contribution*, in which volunteers contribute data, 2) *collaboration*, in which scientists design the project and do the reporting, but volunteers contribute data and may analyze data and 3) *co-creation*, in which both volunteers and scientists are involved in all parts of the project from planning to the interpretation of results. In the context of news making, a similar type of categorization can be used for describing the co-operation types. Crowdsourcing, when defined as tasks to be carried out by the crowd, can be seen to apply to at least the first two types of collaboration.

In journalism, most often readers or volunteers *contribute* content, that is, they send comments, photos and videos to the newsroom and the journalists control the process and publish the news. This type of participation is typically enabled and encouraged by the news organization by providing a possibility to submit content directly from the mobile phone or through online sites. The advantages are clear: new ideas and topics flow from the audience to the newsroom, newsrooms receive cheap content that often interests people in a different way than the usual journalistic content and the process itself strengthens the relationship between citizens and media outlets.

However, volunteers can attain a more equal position when they become reader reporters who create content more independently or help the newsroom with their special information or expertise. Here the news making process resembles more a *collaborative* process. The citizen's role is more of an equal co-worker when the professionals and volunteers join forces to analyze data, such as in open data projects, but where the reporting of the results is still done by professionals. Another example of collaboration are cases where professional journalists use eye-witnesses as informants when reporting breaking news when no professionals are present, or when the eye-witnesses are more informed of the event or possess alternative viewpoints. Professional journalists are transforming into mentors, curators or enablers who are interacting with the users in various ways [7],[25],[45]. The benefits are clear here too - there is often, if not always, more expertise among the audience than in the busy newsroom.

The third stage in the user - newsroom interaction can be called a *co-creative process.* The citizen content creators and professional journalists are working as equals in ideating the news, collecting information and analyzing it, and collaborating even in the reporting jointly. This third stage is a rare model due to the difficulty of opening the journalistic work process into a more democratic one [11],[34]. It is also somewhat unclear as to what kind of economical agreement this kind of co-creation should be based on. When do the volunteers turn into professionals?

2.3 Tools for mobile and location-based news assignments

In order to enable readers to participate in crowdsourcing by carrying out news reporting assignments, one solution is to deliver the assignments to or enable access to them via mobile handheld devices. Solutions vary from using text messages (SMS), social media (Twitter, Facebook) and email to dedicated mobile clients and platforms for news reporting and assignments [15],[43]. CNN is one of the first large news organizations to provide a list of themes to report on in their mobile application for registered reader reporters (iReporters[4]). Readers are asked to share footage and experiences on specific topics, such as the Japanese nuclear catastrophe in spring 2011. A step further is the San Jose State University campus news publication Spartan Daily[5] which provides a mobile client for mobile content creation (Tackable[6]). It geotags captured photos and places them onto a map. It also enables readers to search for assignments based on a map of the campus area. By carrying out tasks readers win points and earn rewards, such as free tacos, i.e., they receive monetary incentives.

Monetary incentives are also used in the case of Scoopshot[7]. It acts as an intermediary, that is, a market place, between the registered citizen photojournalists and the news organizations. It provides a mobile client that enables uploading of photos based on own initiative and pricing them. It also provides a listing of current available tasks to carry out based on the current location of the mobile phone. Tasks can be offered by news organizations to a larger crowd or to a media organization's own recruited community of participants.

[1] http://www.propublica.org/ion/reporting-network
[2] http://international.ohmynews.com/join-our-team/
[3] http://www.huffingtonpost.com/
[4] http://ireport.cnn.com/
[5] http://spartandaily.com/
[6] http://www.tackable.com/about/
[7] http://www.scoopshot.com/

As these examples show, the mobile solutions for mobile crowdsourcing with news reporting assignments vary from using simple text messages that are accessible by all who have a mobile phone to sophisticated mobile clients that require smartphones and a data subscription or access to a Wi-Fi network. Furthermore, participation and its compensation vary from voluntary work to semi-professional type of participation with incentives offered for the tasks carried out.

2.4 Preferences in location-based services

In location-based crowdsourcing when using location-based assignments and geotagging, we are dealing with mobile users' location information and the whereabouts of the mobile users. This type of personal information that can reveal for example patterns of daily routines, personal time spending locations and personal spaces, is sensitive for many users [3][9][17][20][21][28][40][41]. Especially in the case of location tracking services (other parties tracking the user's location), the concerns are greater than when using position aware services that rely on the device's knowledge of its own location [3].

Earlier research shows that users' willingness to share their whereabouts varies. To reduce the users' privacy concerns and increase the acceptability of LBS (location-based services), feedback from the service [40] as well as context-aware solutions and adaptation of sharing can be used [29]. Furthermore, factors affecting willingness to disclose location information have been reported as 1) the identity of the requester (who), 2) the reason for requesting (why), and 3) the precision of the request (what) [9].

Recent studies report a number of other factors that affect the willingness to share location information. When looking at sharing location with their social network, users appear more comfortable sharing locations visited by a large and diverse set of people than places visited by fewer people [39]. Users want to protect their home location, obscure their identity and not reveal their precise location or schedule [8]. Approximate and vague levels of location disclosure are reported to be preferred [24],[32]. On the other hand, studies show that if users find that the sharing of location information is useful for them, they are more willing to disclose their location [1], [10]. For example, in the context of news making participants assessed it to be useful that the newsroom could locate professional reporters working in the field as well as reporters in the field could locate each other for organizing the reporting work [42]. To sum up, the willingness to share location based information depends on who wants to know, why the information is needed and what precisely is asked, in addition to the usefulness of sharing, fun and the social context.

Previous studies have presented technical solutions for how users can use LBS without revealing their location information by using a location anonymizer and a privacy-aware query processor [27]. The research has come to discuss technical implications, describing how privacy is related to security and trust [9], how to prevent undesired attacks [37], or the role of push and pull technologies [46]. Furthermore, Kelley et al. [20] found in case of location based advertising that more advanced privacy settings than simple opt-in, opt-out would make participants feel more comfortable with sharing their location with advertisers and lead to sharing more information with them. Being able to control the sharing of information with rules related to the user's time, place and schedule, appears to be the most resistant way to prevent users from mistakenly revealing location information they do not want to disclose [20].

As the aim of our research was to support the development of the future crowdsourcing processes by using location-based assignments, one of the issues to consider is the privacy related preferences of location information. Finding solutions that are acceptable to a wide variety of users is important to ensure not only the contributions but also the democratic representation of the voice of the audience. Privacy related issues are addressed in the findings of our studies and the implications for the development of crowdsourcing processes of news are presented.

3. STUDY 1

The goal of the first study was to support the development of new crowdsourcing processes in hyperlocal news production. One of the Finnish hyperlocal news publishers that publishes online news and two print tabloids in the Helsinki metropolitan area, is developing their reader reporter concept. The contribution of photos from the mobile context is currently enabled by MMS messages. In addition, email and online submission is enabled. Most of the reader's photos are published in an online gallery.

Incoming photos with short descriptive texts of about 200 characters when submitted from the mobile phone are used by the online journalists to spot interesting story ideas and breaking news, such as accidents. When the journalist spots an interesting topic, he/she contacts the reader who submitted the photo as well as other relevant informants such as officials to inquire further information. In case of accidents, the news desk sometimes is ahead of the officials on the facts about the incident. The most interesting story ideas submitted as photos are turned into online news stories by the journalists in 10-15 minutes. Some of these stories are also used in print tabloids. Furthermore, writing, submitting and publishing of reader's stories is supported online. Monetary incentives are paid for the reader's photos published in print tabloids. These incentives usually vary from two movie tickets (value 17 euros) to a maximum of 100 euros. As the news organization was considering the use of locating and location-based assignments, we aimed to explore the readers' perceptions on the use of mobile LBA and automatic geotagging of the news content to gain an initial understanding of the acceptability and related preferences to support the process development.

In the first study in September 2010 [43], one of the themes we explored was how readers who participated in the hyperlocal news creation by contributing news photos perceived future scenarios on location-based assignments (LBA) and geotagging of news photos. We focus here on these results from the interviews (see also [43]). Based on earlier research on privacy concerns, we expected that participants would primarily be concerned with locating and hesitant to disclose their location. This proved to be the case on the personal level for many. On the other hand, participants identified the created value and particularly the perceptions towards geotagging were positive as described next.

3.1 Method

Participants. Nine readers were recruited to participate in an interview on their experiences and future processes by a journalist working in the newsroom of the hyperlocal news publisher. All participants had been rewarded recently for at least one photo, which had been published in a printed news tabloid. The rewards they had received varied from two movie tickets (value 17 euros) to 100 euros. Five participants were 51-60 years old, and four were 16-39 years old. Four participants were female. Two participants had prior experience of using location-based services.

Procedure. Three participants agreed to answer through an online questionnaire, and six were interviewed. The same questions were asked both in the interviews and in the online questionnaire. Questions related to subjective perceptions and views were asked after presenting the scenario. The themes for the questions were created by paying attention to privacy preference related themes from earlier literature [9],[17],[24],[29],[40] on when, where and in what situations they would agree or would not agree to locating in order to receive reporting assignments. We did not mention privacy in the interview questions, following the approach of Kindberg et al. [21]. The interviews were recorded and transcribed. The participants were compensated with two movie tickets (value 17 euros).

Analysis. The data was analyzed by using a qualitative data-driven content analysis for open questions, using open coding for emerging themes. The coding was fixed as the analysis emerged, grouping codes under higher level categories.

3.2 Results

3.2.1 Perceptions on LBA for news reporting

When inquiring about perceptions on locating and location-based news reporting assignments, the following scenario was first described to the participants:

"You have agreed to act as a reader reporter. You have given permission to the newsroom to locate your mobile phone. Based on location, mobile assignments asking to capture multimedia or for reporting can be sent to your mobile phone, for example if there is a fire close to you."

When presented with the scenario, four groups of participants' perceptions emerged: 1) positive (1/9), 2) conditionally positive (3/9), 3) reluctant, i.e. who acknowledged the value of locationing for news reporting but who were not willing to be located themselves (3/9), and 4) negative, i.e. against the idea (2/9). The prerequisites mentioned by the participants for taking part in this type of scenario were related to minimizing disturbance by remaining in control over 1) the availability for receiving assignments, and 2) when and where to be located, as well as 3) the answering to the assignment so that it is not compulsory and one is able to decide whether to take part or not. The preferences mentioned were related to temporal (holiday, workday, not all the time), situational (when occupied with something else, such as with the family), and locational (home, workplace, downtown) issues. Specifically, areas further away from home, for example, when on the move somewhere in the city, downtown or similar, were mentioned as acceptable places to locate for assignments.

Privacy issues and concerns were mentioned spontaneously by the participants (4/9). Three mentioned privacy protection and two mentioned the "*feeling of being watched*" or *"observed"*. One of the participants described how his/her attitude towards locating depends on the consideration of the perceived benefits and risks: "*Then there is the issue of privacy… one need to consider the risks and the benefits, whether the benefits are greater than the risks." P-3*.

On the other hand, some participants (3/9) explicitly expressed that they would allow locating for receiving news reporting assignments if they would be compensated for carrying out the task and would remain in control of the locating and availability. One of them did not bring out the privacy related issues during the interview, but rather approached locating and availability to be an issue to be solved with technology: *"It would not bother me if it had been agreed on and you would get compensation for going to the scene based on a request… When I do not want it, when I am in general not able to go on a gig, you could perhaps activate it yourself … If the service could be activated on and off, that would be the best." P-6*.

One of the participants described how he/she considers the benefit and cost relationship of privacy on a personal level to depend on the expected incentive: *"If I get paid enough, I can give up my privacy." P-7*. Furthermore, two participants compared the activity to contract work: *"One has to get a reward for contract work." P-8*. The results indicate that people may be willing to give up the privacy of their location in exchange for a monetary benefit. On the other hand, as the nature of the activity that the readers are to be engaged to changes, the expectations of the participants may change towards contracted freelancing work. These issues need to be considered when developing the crowdsourcing based activity further, for example, on how the new way of working is launched and how possible incentives are used in the case of a crowdsourcing type of activity.

3.2.2 Geotagging of content

Geotagged, time-stamped media content submitted by the readers would help the news reporting work at the news desk by 1) giving accurate information of the location and time line of the capture, 2) proving the authenticity of the material and 3) being able to map the content automatically when publishing the news online. Privacy related issues and concerns have in recent years been discussed in the media, like the potential dangers such as stalking and burglaries when users reveal their geolocation in social media. We therefore inquired how the participants view the automatic geotagging of news content. The following scenario was first described to them:

"The location of the scene of capturing media, like photos and videos, can automatically be added to the content based on the location of the mobile phone. Location information is used, for example, so that the photo or video you submitted is geolocated on a map in an online publication."(Scenario 2)

The participants found geotagging to be useful and to create added value in the case of news related content 1) for the news reporting phase as well as 2) for the readers. One participant had used the automatic geotagging of content on a mobile phone. He mentioned that he could control geotagging easily, taking into account privacy issues as well. He found that geotagging helps the journalist to do his/her job more easily, since sometimes there are problems in placing an event to the right location. *"… I feel that especially if I send only a photo [without a description], then the person [journalist] who continues from there [the reporting] can really picture the right location from that information." P-4*.

None of the participants spontaneously mentioned any places or locations that they would not want to geotag. When specifically asked for possible places that they would not like to geotag or disclose, three participants mentioned content created at *"home"*. One participant mentioned as a possible case a situation where the person should have been somewhere else at the time of capturing: *"Maybe someone has a need [not to reveal their location] if one should be somewhere else instead." P-8*.

These results on geotagging of media content therefore indicate that the participants may see more benefit than risk in the automatic geotagging of captured content for news reporting purposes. Furthermore, geotagging was perceived to create value in the process of news making by increasing the accuracy of the reporting.

4. STUDY 2

In order to gain a deeper understanding of the perceptions and preferences related to receiving location-based news reporting assignments and the geotagging of captured news photos and videos, we conducted a quasi-experiment in field conditions [18]. We aimed to provide the news publisher with information to further develop their collaboration and news publishing activities.

4.1 Method

In the quasi-experiment we used a simulated mobile crowdsourcing process with location-based assignments (LBA) [43]. The assignments were delivered as SMS messages to the test phone. The experiment was carried out in the mobile context with a within-subjects design. The experiment consisted of 1) four tasks completed with the mobile phone, 2) an interview after completing all the tasks, and 3) filling forms, including a pre- and a post-test questionnaire [43].

4.1.1 Participants

The sample consisted of 19 voluntary participants, who were interested in new mobile services that enable to send reader's content to news organizations [43]. Participants (12 female, 7 male) were recruited through email lists as well as university web pages to participate in a reader reporting experiment with mobile phones. The average age of the participants was 29 years (Md=24). Most participants (16/19) were aged between 20 and 30 years, and the rest were 43, 44 and 61 years old.

Eleven participants were students studying engineering, journalism, visual journalism or media. One participant was a photographer and one a journalist. All participants had prior experience of using mobile phones for photo capture. The majority (10/19) of the participants had experience of using a mobile phone for sending or sharing photos or videos with others. Three participants had prior experience of sending reader's photos or videos to newspapers. Almost half of the participants (8/19) used a navigator or a navigation service on a mobile phone monthly or more frequently. Three participants had prior experience of other location-based services. The participants were compensated with two movie tickets (value 17 euros).

4.1.2 Apparatus

The mobile phone used in the quasi-experiment was HTC Legend. Both the phone's own functionalities (MMS, photo and video capture) and a dedicated mobile service client OKReportteri [43] was used for capturing and uploading mobile media content. SMS messages were used for delivering the LBA. Regarding location information, OKReportteri enabled the uploading of captured photo and video content to a backend service, from which the uploaded content and related metadata including the location of media content capture could be browsed with a standard browser. As the capturing of media content with the client was started, an approximate location was searched with network-based locationing. This search was visible to the user on the mobile client's user interface. After the capturing of a photo or video, the network-based approximate location was always attached, but a GPS based location was attached only if the user agreed to the searching of the precise location.

4.1.3 Location-based assignments

In the experiment we simulated the newsroom locating the mobile users by indicating in the description of the test assignments that the participant's location was known [43]. The location-based assignments were sent to the test phone as text (SMS) messages prior to each task within the test session that was arranged in a predefined pedestrian area. The assignments indicated an approximate location (central square, pedestrian street, downtown, close to the boulevard), the topic of the assignment and instructions for capturing and sending [43]. Each participant received two photo and two video assignments. The order of the test conditions was pseudo-randomly counterbalanced. The following tasks exemplify photo and video assignments:

"According to the newsroom's information, you are close to the central park. Please take a photo of a typical tree in the cityscape and upload it. Use OKReportteri for capturing and uploading." (a photo task)

"According to the newsroom's information, you are downtown. Please take a video of typical problem to fix in the cityscape. The maximum length of the video is 10 seconds. Send the video as an MMS message to the newsroom number." (a video task)

4.1.4 Procedure

Prior to the test, the participants were asked to fill in a paper-based questionnaire with demographic and other background information. Next, the participants received training for using the mobile phone used in the experiment. After carrying out the four mobile location-based assignments in the mobile context, the participants were interviewed about their experiences. The interview questions covered how the participant perceived 1) the assignments generally, 2) the usage of the location information for assignments, 3) the advantages and disadvantages of using the location information, and 4) the needs related to situational, locational and temporal control in the case of LBA. Privacy issues were addressed only on the participant's spontaneous initiative.

After the post-test interview, the participants were asked to fill in a paper-based questionnaire [31] which addressed 1) their preferences to receive LBA under different context and assignment related characteristics, as well as to 2) geotag their content and 3) the usage of the content's geotag information. By collecting this information at the end of the experiment, we aimed at getting more realistic perceptions than we would have received by asking for assessments without hands-on experience of LBA.

The post-test questionnaire had three components: 1) preferences to share location information in the case of geotagging and location-based assignments with six dimensions for participation preferences (Table 1), adapting the privacy control dimensions by Myles et al. [29] and using prior research findings from sections 2.4 and 4.2, 2) assessment of the level of the participants' privacy concerns, applying the IUIPC scale [26], and 3) the participants' perception of the benefits or risks [40] of precise location sharing for receiving LBA and geotagging of media (Table 1).

To get a general background measure for the participants' privacy concern, we selected six items from the Internet User's Information Privacy Concerns instrument (IUIPC) [24],[40]. We used the following items from the IUIPC scale: 1) Control (nr.2 "Consumer control of personal information lies at the heart of consumer privacy."), 2) Awareness (nr.3 "It is very important to me that I am aware and knowledgeable about how my personal information will be used."), 3) Collection (nr.4 "I'm concerned that online companies are collecting too much personal information about me."), 4) Unauthorized Secondary Use (nr.4, "Online companies should never share personal information with other companies unless it has been authorized by the individuals who provided the information."), 5) Improper Access (nr.3 "Online companies should take more steps to make sure that unauthorized people cannot access personal information in their companies.") and 6) Risk Belief (nr.1, "In general, it would be

risky to give the newsroom a permission to locate the mobile phone."). The first five items were used as a scale for the general privacy concern of the participants. The higher the score the more concerned the person is for his/her privacy. The sixth item, Risk Belief, was used separately for the assessment of perceived risk of locating within the context of news reporting. A seven-point Likert scale was used for the assessment of the statements (1=Strongly disagree, 7=Strongly agree).

Table 1. Dimensions of participation preferences and assessment of perceived risk or benefit when using LBA and geotags.

Preference	Themes of items	Nr of items
Organization: share the geotag	Type of news organization (local or national) with which the *geotag is shared*	2
Organization: publish the geotag	Type of the news organization (local or national) that may *use the geotag of content in publishing*	2
Organization: send LBA	Type of the news organization (local or national) *allowed to send LBA*	2
Task type	Type of the *contribution asked for in LBA*: write a news story, conduct an interview, shoot a photo, shoot a video clip	4
Temporal	*When to receive LBA*: anytime, weekdays, weekends, during the day, evenings	5
Location to receive LBA	*Where to receive LBA*: anywhere, downtown, when distance less than 1 km/5 km from the scene	4
Spatial precision of the location query	*Precise* geolocation (i.e., address, place), *approximate* (district, neighborhood), *vague* (city), or *anonymous but precise*	4
Situation	Task context: When having *nothing more important* to do, during *free time*, when *working or studying*. Social context: when *alone*, when *in the company of others*	5
Perceived risk or benefit	Disclosing the *precise location* of the mobile phone, *geotagging* of the content	2

4.1.5 Analysis

The audiorecorded post-test interviews were transcribed and analyzed with data-driven content analysis in NVivo8. As analysis emerged initial open codes were replaced with fixed codes and categorized. Questionnaire data was analyzed with SPSS analysis tool using nonparametric methods, that is, descriptive statistics and with nonparametric correlations (bivariate with Kendall's tau, 2-tailed). The 5-item scale for privacy concern was tested for internal consistency reliability with Cronbach's alpha (α=.73).

4.2 Results

4.2.1 Assessed privacy concern and risk belief

Based on the post-test questionnaire we calculated a general privacy concern score for each participant as the sum of the five IUIPC scale items (1-5). All participants were concerned with their privacy (Privacy concern score: min=5, max=7, Md=6.5, M=6.39, SD=.58). However, based on nonparametric correlations, the privacy concern score did not have statistically significant correlations with any other questionnaire items. This indicates that the general privacy concern score does not give a prediction of participant's perceptions of the privacy concerns in the specific context of crowdsourced news reporting. This is reflected with participants' assessment the IUIPC item on Risk belief: *"In general, it would be risky to give the newsroom a permission to locate the mobile phone."* Statement was disagreed with (Scale 1="Strongly disagree", 7="Strongly agree": min=2, max=7, Md=3, M=3.68, SD=1.57). Our results therefore indicate that even though participants were concerned for their privacy in general, most of them did not find it especially risky to share their location with the newsroom if acting as reader reporters.

Most of the participants assessed giving permission to locate their mobile phone precisely more beneficial than risky (*"Giving permission to the newsroom to locate my mobile phone precisely is…"* Scale: 1="Much more risky than beneficial", 7="Much more beneficial than risky"; min=2, max=7, Md=5, M=4.74, SD=1.33). This is consistent with the findings on Risk belief. Most participants therefore found benefit in sharing the precise location in the context of mobile news making and assessing the benefits higher than the risks involved.

Geotagging precisely the location of the multimedia capture was assessed as more beneficial than risky by all participants (*"Geotagging the precise location of the place of capture to the multimedia I send to the newsroom is…"* Scale: 1="Much more risky than beneficial", 7="Much more beneficial than risky"; min=5, max=7, Md=6, M=5.95, SD=.78). This finding supports our finding from the first study that in the context of news the participants see value in geotagging and in the use of geotags.

4.2.2 Interview results

The interviews revealed both advantages and disadvantages related to LBA. The mentioned advantages were: getting tip-offs for relevant content that newsroom is interested in, proving the authenticity of the material and therefore increasing the reliability of the reporting, enabling the newsroom to get what they are interested in, and enabling faster news reporting when the newsroom is able to spot someone close-by.

The perceptions on the disadvantages of LBA were related to privacy and disturbance (see Table 2). Three groups of privacy related issues emerged: 1) revealing personal and private time spending locations and patterns 2) the location information ending up in wrong hands or misused for stalking and 3) revealing some location accidentally, which one would like to keep secret from friends or close-ones. One participant exemplified accidental revealing of a secret location that one could be "*caught lying*" and "*end up in trouble*". This could happen if one is somewhere else where one has told others, like friends, to be at, in case one submits news material based on location information and the identity is revealed. Only three participants specifically mentioned that there would be no disadvantages.

Table 2. Mentioned disadvantages of LBA.

Category	Count	Themes	Count
Privacy	8/19	Personal and private time spending locations revealed	3
		Location information ends up in wrong hands or is misused	2
		A "secret" location is revealed accidentally to friends or similar	3
Disturbance	5/19	Assignment messages received continuously	3
		Private leisure time disturbed	2

The specific locations mentioned by the interviewees that they would not like to disclose or be located at were 1) places described as *"shady"*, *"not acceptable"*, *"embarrassing by their nature"* (4/19), and 2) home or other private places (2/19). By contrast, downtown was mentioned as a specific acceptable place

to locate (2/19), similarly to the first study. Some participants said that they would prefer location obfuscation, that is, approximate or vague location disclosure over precise.

Situations in which the participants mentioned a need to control the disclosure of the location were when one wants to be in peace, that is, undisturbed, like on a holiday or at work (3/19), or if doing something illegal (1/19). On the other hand, some participants mentioned that the need for the control of both location disclosure and availability would depend on the agreement made for reporting, and who has access to and is using the location information. One participant spontaneously raised the monetary incentive to change his/her attitude towards being available for assignments, similarly to the first study.

4.2.3 Questionnaire results

The post-test questionnaire focused on the participants' preferences in the case of LBA and geotagging. We used the following type of questionnaire items. For example, in the case of agreement related to location, the item statement for "approximate location" (see Table 1) was the following: *"The newsroom can locate my mobile phone at the precision of the neighborhood because I have given permission to the newsroom to locate my mobile phone"*. The scale used for all the items was a seven-point Likert scale (1="Strongly disagree", 7="Strongly agree"). To illustrate the results, we present the assessments in three groups of frequencies by combining disagreements (1-3) to one group ("Disagree"), neutral to one group (4="Neither agree or disagree"), and agreements (5-7) to one group ("Agree").

Organization type. The type of the news organization, whether 1) hyperlocal or 2) national, did not affect the preference to share or publish the geotag nor to receive LBA sent by the newsrooms (Table 3). This seems to indicate that the willingness to collaborate with and trust in both types of organizations is similar.

Table 3. Preferences related to the type of the news organization.

Type of news organization	Disagree	Neutral	Agree
Sharing the geotagged footage with hyperlocal news	0	1	18
Sharing the geotagged footage with national news	0	1	18
Hyperlocal news can geolocate the geotagged footage when published	1	2	16
National news can geolocate the geotagged footage when published	1	1	17
Hyperlocal can send LBA	1	0	18
National can send LBA	1	0	18

Preference for the task type. Shooting photos and video clips was the most preferred task, followed by writing a news article (Table 4). We expected that making an interview would not be preferred by the participants, since it involves being in contact with externals and not being able to carry out the assignment in a very short time. As can be seen from Table 4, making interviews is the least preferred, but still over half of the participants were willing to carry out interview assignments as well. The results indicate that a diversity of contribution types can be asked for and used in the collaboration when using LBA.

Table 4. Preference for the task type.

Type of contribution asked for	Disagree	Neutral	Agree
Write a news article	2	0	17
Conduct an interview	5	2	12
Shoot a photo	1	0	18
Shoot a video clip	1	0	18

Temporal preferences to receive LBA. In general, the participants wanted to control when to receive LBA, but no specific best time can be identified for LBA based on the results (Table 5). This calls for personal control of availability that could be supported by context-aware solutions or with a simple opt-in, opt-out solution.

Table 5. Temporal preference to receive LBA.

Time to receive LBA	Disagree	Neutral	Agree
Any time	9	2	8
Weekdays	5	0	14
Weekends	6	1	12
Daytime	3	0	16
Evenings	4	0	15

Location preferences. The participants assessed their preference to receive LBA in four locations (see Table 6). The proximity to the reporting location seems to be the most important factor for the location related preference to receive LBA. Instead of the push based solution studied here, location-based retrieval (pull) of tasks is a relevant solution to be considered, such as that provided by Tackable or Scoopshot (section 2.3) or proposed by Alt et al. [1].

Table 6. Preferences related to the location of receiving LBA.

Location to receive LBA	Disagree	Neutral	Agree
Anywhere	9	2	8
Downtown	2	4	13
Less than 1 km away from the scene	2	0	17
Less than 5 km away from the scene	5	3	11

Precision of location query. The participants clearly preferred the obfuscation of their location when it comes to locating their mobile phone. Both approximate and vague levels were preferred over precise locating. In addition, anonymous locating in the case of precise locating was preferred, compared with precise locating. Therefore, the obfuscation of the location by lowering the preciseness as well as using anonymity seems to be acceptable and less intrusive. Somewhat surprisingly, over half of the participants were willing to share their precise location with no obfuscation. However, as indicated by the previous results on preferring to receive LBA in the proximity of the reporting location, using either approximate locating or using anonymous but precise locating seem a feasible solution.

Table 7. Preference on the precision of location disclosure.

Preciseness of locating	Disagree	Neutral	Agree
Precise	6	1	12
Approximate (e.g. neighborhood)	1	0	18
Vague (e.g. town)	1	0	18
Anonymous, but precise	2	0	17

Preference for the situation to receive LBA. The participants were the most willing to agree to receive LBA for news content when they have nothing else to do (Table 8). The next most preferred times were in leisure time and alone. Interestingly, about half of the participants were willing to receive LBA when working or studying or when in the company of others. It therefore seems that these participants do not perceive LBA as a disturbance.

Table 8. Preference for the situation to receive LBA.

Context	Disagree	Neutral	Agree
When nothing else to do	1	1	17
In leisure time	4	1	14
When working or studying	7	1	11
When alone	5	1	13
In the company of others	6	3	10

5. DISCUSSION

The goal of our research was to study the preferences to participate in location-based crowdsourcing of news content with location-based assignments (LBA) and attitudes towards geotagging of news content. Our practical aim was to support the development of mobile location-based crowdsourcing processes for hyperlocal news. The presented framework for participation preferences can be applied when studying and implementing mobile crowdsourcing processes. We describe our findings and present implications for designing location-based crowdsourcing processes in the context of news journalism.

RQ1. *What affects mobile users' participation preferences in location-based crowdsourcing with LBA that is facilitated by a news organization?*

Based on earlier research and the results of our first study, we created an initial framework for studying the participation preferences and concerns. It was used in the planning of the second study and in the development of the questionnaire items for users' preferences. We created initially items for six dimensions of preferences (see Table 1):

1) Organization type, 2) Task type, 3) Temporal context, 4) Location to receive LBA, 5) Precision of location query, and 6) Situation (Social and task context).

Organization type. Earlier research shows that *who* is asking for the location disclosure is important for the users [9][29]. In our second study we investigated whether there is a difference if the news organization sending LBA or using geotags is national or hyperlocal. Participants were willing to share their location information independent of the news organization's type for geotagging of news footage and for allowing the use of geolocated content by the news organization when published. No difference between national or hyperlocal news was found for LBA. All except one participant was willing to receive LBA. When using readers' geolocated content in news publishing, the anonymity or pseudonymity of the content creator when publishing may further advance the willingness to add the geotag to reader's content.

These results are promising as they open a variety of possibilities for different types of news organizations to develop their collaboration processes with the audience. Using geotags enables developing new forms of news stories for the audience to consume online and specifically with mobile devices. Geotags enable, for example, pull or push of location-based news. Furthermore, geolocated news could be available through existing social media solutions, such as Foursquare or Facebook or with augmented reality solutions (e.g. Leyar, Junaio or dedicated news clients). These could attract more participants to news making.

Task type. In the second study, we looked at participants' preferences to carry out four types of reporting tasks: Writing a story, carrying out an interview, shooting a photo and shooting a video clip. Shooting news footage (photos, video clips) was the most preferred, along with writing a news story. Conducting an interview was the least preferred, but still over half of the participants were willing to conduct interviews. Requested contribution types of tasks (type of content, activity, needed effort) are therefore relevant aspects to consider when planning the activities as also discussed by Alt et al. [1]. Contribution types or more generally the type of activity that is asked for could also be used in the profiling of the participants, along with special skills, expertise, interests, and the reporters' equipment [41]. Furthermore, the task description should provide the needed information in a compact and easily understandable form [42].

Temporal context. Temporal preferences are related to *when* participants are willing to receive or alternatively retrieve or carry out LBA. In both of the studies, the temporal preferences of the participants to receive LBA varied. This indicates a need to be able to control the receiving of location-based assignments, such as using context-aware solutions that automatically adapt the availability for receiving LBA, like calendar information [29]. However, temporal preferences may also depend on other factors, such as the actual implementation of the LBA process such as: the type and nature of the technological solution or tool that is used for delivering LBA; the use of push or pull solutions; the intrusiveness of the notification; the details of the possible official agreement between the organization and the reader reporter on LBA, such as incentives or a possibility to select and undertake the task to themselves, urgency of the request and whether the LBA is sent to one or a group reporters or generally to anyone involved. These issues are not only related to temporal preferences but also more generally to developing the models, mobile tools and processes of crowdsourcing [1], [35].

Situation. When studying the preferences related to mobile user's situation at the time of receiving the LBA, we looked specifically at the *social* (alone, in the company of others) and *parallel task dimensions* (when nothing else to do, in leisure time, when working or studying) of the context of use [19]. Receiving an assignment was the most preferred when a person had "nothing else to do" followed by "in leisure time" or "when alone". However, over a half of the participants of the second study were willing to receive LBA also "when working or studying" or "in the company of others". Similar issues as presented for temporal context may affect the willingness to receive the assignments. As described for temporal context these aspects can be supported by technology and the developed crowdsourcing processes.

Location. Finally, we studied in both of the studies the perceptions of using location information for LBA and geotagging. The location information was clearly important for participants. In the first study the location related preferences and concerns were primarily related to the publicity of the place or the perceived private nature of the place, the ongoing activity or revealing things about oneself that one would not want to share. These were echoed in the interviews of the second study as well. In the second study, we studied the preferences from the point of view of the place of receiving LBA and the precision of the location query for locating the mobile phone for sending LBA. The proximity to the reporting location was important; the shorter the better. This indicates the importance of receiving relevant and potential tasks to carry out if these are delivered to the phone based on the location of the reader reporter's mobile phone. Alternatively, being able to retrieve LBA based on own location as in [1] or in real-life solutions of Spartan Daily or Scoopshot can be considered. Based on our findings, the effort required due to travelling is an important factor when reporter is considering whether to carry out a task or not. Therefore, solutions for delivering or retrieving LBA that are potentially relevant and feasible to the users to carry out is important.

Obfuscation of location or identity information was clearly preferred over precise locating for LBA. The approximate level of location preciseness (neighbourhood) was preferred in addition to vague level. This seems a reasonable level for news reporting purposes as well. In addition, in combination with the proximity

of the reporting scene to the participant, this seems a good option for locating especially when carried out by the news organization and not initiated by the mobile user. Although both locating by the news organization and user initiated retrieval of LBA based on location seem a possible solution, the user initiated retrieval may be more acceptable for a larger number of users, since it potentially decreases the feeling of being monitored or tracked and the intrusiveness of the location request.

Incentive. In addition to the six dimensions of preferences that we defined for the initial framework, findings indicate a seventh dimension, that is, incentives. The interview results from both of the studies indicate that a monetary incentive and possibly an a priori contract for carrying out the task may have an effect on the willingness to share location information when the LBA is sent based on the locating of the reporter's mobile phone by the news organization. However, in practical terms news organizations need to consider as to what kind of effects incentives or contracts have on the activity and on the collaboration in hyperlocal news making. The reader participation to hyperlocal news is currently based primarily on volunteering. In a further study on readers' motivations to contribute to hyperlocal news [44], 39 active readers reported most often fun and the opportunity to get a reward as motivations. Informing others of local issues was the third most often reported motivator. Results indicate that monetary incentives or other ways to get feedback are important [2] when designing crowdsourcing processes.

Further dimensions for preferences. Our findings and previous research suggest also further dimensions to be included in the framework for preference dimensions. These include the anonymity or pseudonymity of the participants. In addition, as discussed earlier, the implementation of the processes and technology, such as use of push or pull of tasks is relevant to consider as a dimension [1]. These issues should therefore be considered when developing the crowdsourcing processes.

RQ2. *How do users perceive the risk of sharing their location information in the context of news making?*

In the first study, most participants were reluctant to share their location information with the newsroom to receive LBA, but they were willing to geotag the created news content. The participants of the second study were concerned for their privacy, when assessed for their general concern for sharing their private information. However, most of them did not find it risky to share their location information with the newsroom. In addition, most participants perceived the benefits of giving permission to locate their mobile phone and geotagging news footage greater than the risks. These findings along with the findings related to the first research question are consistent with findings from earlier studies e.g. [9]. When users identify *who* is requesting the location information and *why* the information is needed, as well as when the sharing is perceived as useful and creating or providing added value, they are more positive towards sharing location related information and privacy concerns are mitigated.

Practical implications. Our results indicate that using location information in reader reporting activity is possible to implement in practice by the news organizations. In case of LBA, this should happen based on an informed consent and agreed terms especially in the case of locating the mobile users based on their mobile location and sending them location-based assignments (push). As discussed earlier, user initiated retrieval of LBA (pull) may be more acceptable than push in terms of considering the privacy related issues. Furthermore, the participants mentioned as benefits for themselves in location-based crowdsourcing the tip-offs for reporting as well as the usefulness and easiness of automatic geotagging for the activity carried out in mobile context [43]. Geotags were also mentioned to provide value by making it easier to identify and use accurate location information in geolocating. This in turn provides value for the audience when consuming news. Overall, the perceived benefits of using location information seem to be assessed higher than the risks indicating that news organizations may explore this potential and develop their processes as well as reported news stories accordingly.

Relevance, limitations and future work. Overall, only a few user studies exist in the field of journalism that support the development of future location-based assignment processes [42][43]. Results and implications based on our studies can be used as initial guidelines when developing LBA and geotagging related processes and tools from the point of view of readers' preferences. Furthermore, the approach presented to studying and categorizing the relevant preference dimensions provides an initial framework to develop and refine further.

The results from our user studies are not directly generalizable due to the small number of participants, opportunistic sample and the studies not being long-term field trials in real-life journalistic processes. The first study inquiring the perceptions of the users based on scenarios of use and the second study being a quasi-experiment in field conditions provide indicative but not definitive results. In addition, the culture and the country in question may have an effect on the findings as well as the organization type may affect the results in the case of "yellow press", for example.

Future research could address the use of mobile assignments as well as LBA in real-life crowdsourcing settings with news organizations and compare use of intermediaries, such as Scoopshot, with news organizations' own reader reporter communities. Specific issues to address could include the motivations to participate in the activity, incentives, solutions for supporting high quality contributions by the participants, as well as the changes in the work processes, roles of the professionals and in the collaboration between the newsroom and readers, for example.

6. CONCLUSIONS

We presented a framework with seven dimensions for the preferences of readers to participate in location-based crowdsourcing of news content. The seven dimensions are 1) Organization type, 2) Task type, 3) Temporal context, 4) Location to receive LBA, 5) Precision of the location query, 6) Situation (Social and task context), and 7) Incentives. We found that all other dimensions except the organization type affected the willingness to receive LBA. Furthermore, we found that most participants of the second study did not find it risky to share their location information with the newsroom. The benefits and created value of LBA and geotagging were mainly perceived greater than the risks, both on a personal level and for news production. Using location information of the reader reporters therefore seems to offer new possibilities for the news organizations. The presented framework can be used in future studies on location-based crowdsourcing and in informing the development of location-based crowdsourcing processes.

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